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TOMCATS

B-1B TESTERS
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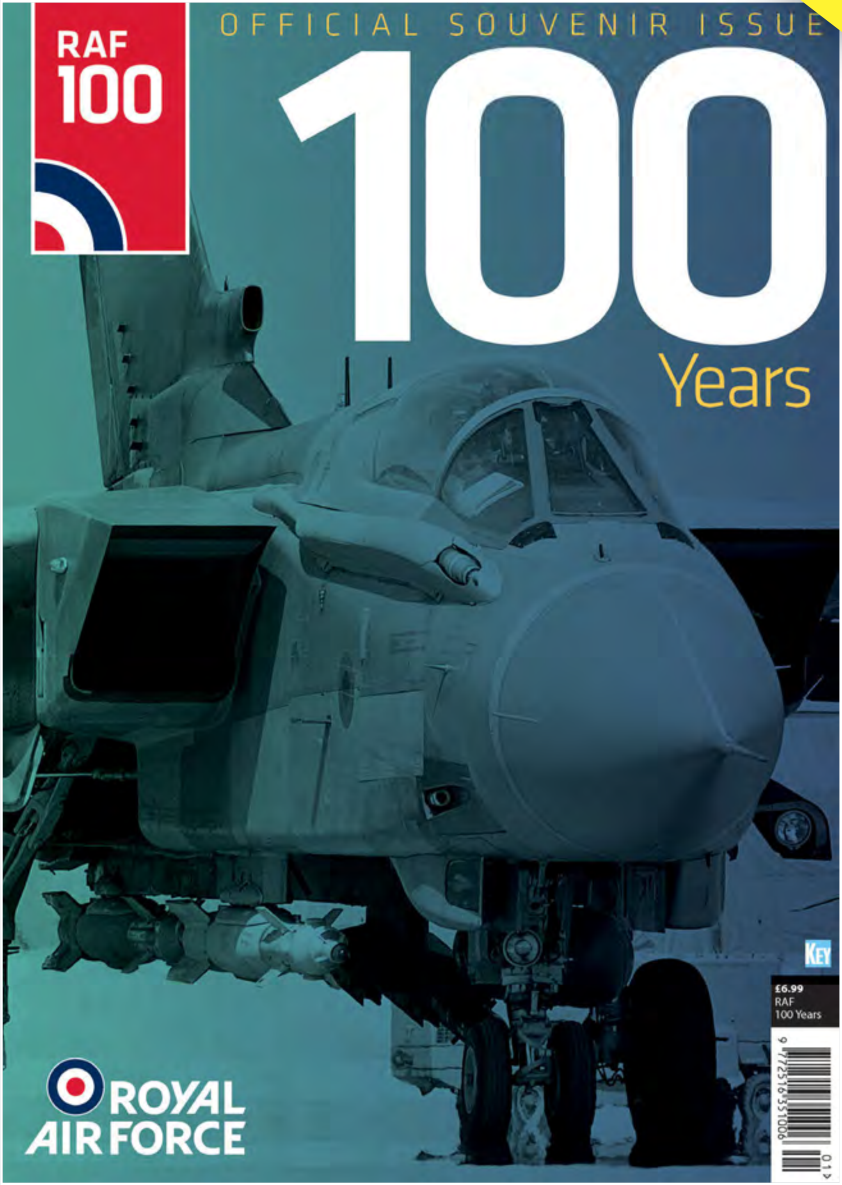

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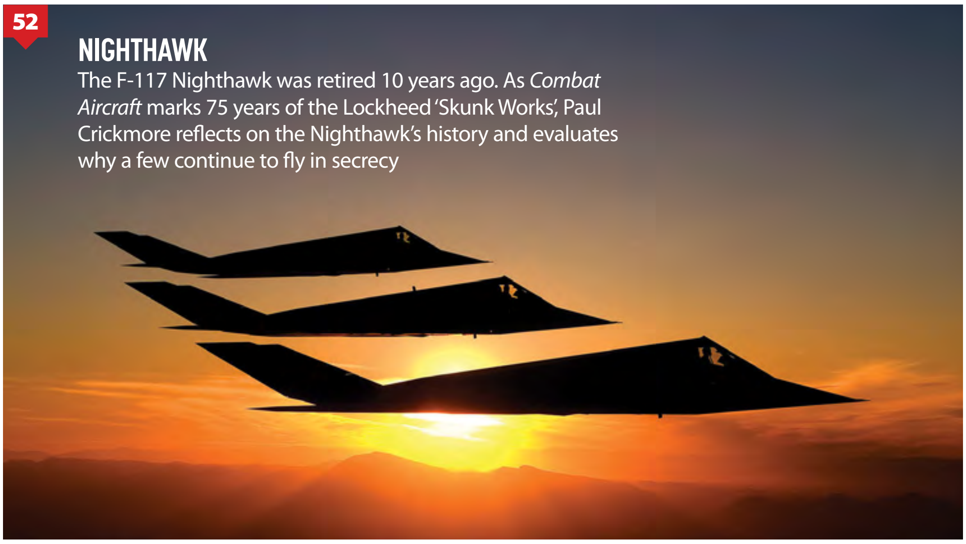

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Rich Cooper

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TORNADO PROVES ITS VALUE ONCE AGAIN

APRIL'S AIR STRIKES on the Syrian regime once again saw British Tornado GR4s in action. The Royal Air Force — in its 100th anniversary year — has turned to its Tornados time and again when duty calls. The latest action saw the GR4s once more employing the potent MBDA Storm Shadow stand-off cruise missile.

The Storm Shadow has a fearsome reputation. First used in anger by the Tornado in Operation 'Telic' over Iraq in 2003, it is known for its unparalleled accuracy. Indeed, during battle damage assessment related to its early use, analysts were concerned that some of the missiles had failed, only to discover that they had actually all penetrated their deep target through the same hole

Their use in the latest strikes, alongside US Tomahawk land attack missiles, was most likely driven by the need to hit buried bunkers. As well as their accuracy, Storm Shadow missiles possess deep penetration capabilities. Storm Shadow has been a weapon unique to the Tornado GR4 in the RAF inventory for the past 15 years, but with just one year's service for the GR4 remaining it is passing to the RAF's Typhoon force, which will undoubtedly be called upon — as the Tornados have been — when this unique weapon fits mission requirements.

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Jamie

Jamie Hunter,
Editor

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Clutching live Storm Shadow cruise missiles, Royal Air Force Tornado GR4s prepare to launch for the Syria strike mission in April.
Crown Copyright

CONTRIBUTOR OF THE MONTH

JAKE MELAMPY

Jake Melampy is an aviation photojournalist from Ohio. His love of aviation began at an early age with the sights and sounds of F-4 Phantom IIs at nearby Wright-Patterson AFB. Since those early days he has gone on to pursue a flying career, piloting business jets in the corporate world and amassing nearly 10,000 hours of flight time in a wide variety of aircraft. In his spare time, he is nearly always trying to point a camera at people and aircraft from the US military, and especially enjoys telling their stories. Given the call sign 'Kodak' during his first ever F-16 air-to-air mission with the Indiana Air National Guard in 2005, he continues to wear that title and name patch with pride.

SYRIAN CHEMICAL WEAPONS SITES ATTACKED

An RAF Tornado GR4 launches from RAF Akrotiri armed with a pair of MBDA Storm Shadow cruise missiles. **Crown Copyright**

F-35 COMPLETES DEVELOPMENT TESTING

THE F-35 JOINT Strike Fighter's $55-billion system development and demonstration (SDD) flight test program was formally completed on April 11 when F-35C test aircraft CF-02 completed a mission to collect loads data while carrying external 2,000lb (907kg) GBU-31 Joint Direct Attack Munitions (JDAM) and AIM-9X air-to-air missiles.

The program began in December 2006 when F-35A test aircraft AA-1 completed its maiden flight. Since then the joint government and industry team, which included 19 test aircraft, has conducted more than 9,200 sorties, accumulated in excess of 17,000 flight hours, and executed over 65,000 test points that verified the design, durability, software, sensors, weapons capability and performance of all three variants of the Lightning II.

The SDD program will formally conclude when the aircraft's initial operational test and evaluation (IOT&E) is completed and full-rate production is approved in late 2019. Pre-IOT&E events are already under way and the full evaluation is scheduled to begin this coming September.

As part of the SDD program the test team conducted six at-sea detachments and performed more than 1,500 vertical landing tests with the F-35B. The developmental flight test team completed 183 weapon separation tests, 46 weapons delivery accuracy (WDA) tests and 33 mission effectiveness tests, which included numerous multi-ship missions that pitted up to eight F-35s against advanced threats.

Although SDD flight-testing has been completed, the program will continue the development of phased capability improvements and modernization of the F-35 under the Joint Program Office's continuous capability development and delivery (C2D2) effort, which will provide Block 4 enhancements. This will provide the Lightning II with incremental capability improvements, allowing the fighter to maintain air dominance against evolving threats.

The F-35A and F-35B are already operational with the USAF and US Marine Corps. The US Navy expects the F-35C carrier variant of the Lightning II to achieve initial operational capability with Block 3F software once the program has completed its final test period in 2019.

F-35C CF-02 operates near NAS Patuxent River, Maryland, during the Joint Strike Fighter program's final system development and demonstration flight on April 11, 2018. **Lockheed Martin**

ALSO THIS MONTH...

'AdAir' update
Draken International finalizes Mirage F1 plans. See *US News*

Australian F-35 update
Block 3F handover for RAAF. See *World News*

COMBINED FORCES FROM the US, UK and France launched a joint attack on April 14 against three Syrian sites that were reportedly involved in chemical weapons production and storage. The operation was conducted in response to an attack carried out by Syria against civilians in Douma on April 7, which killed at least 70. Launched in the early morning hours the strikes targeted facilities near Damascus and Homs.

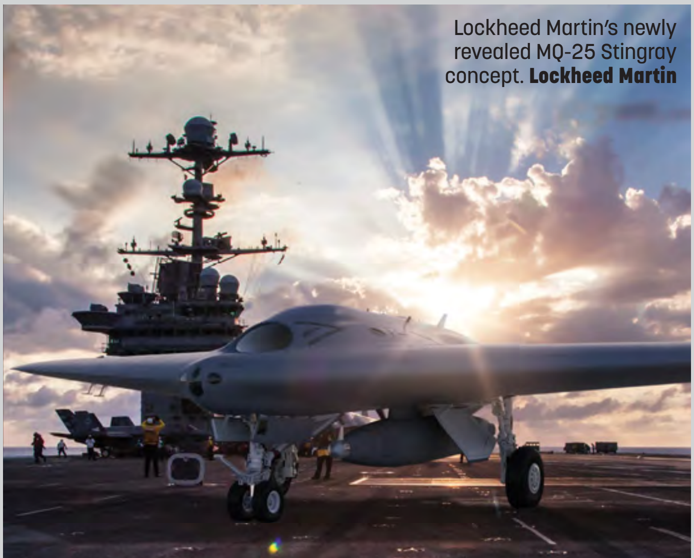
US Involvement included the launch of 66 BGM-109 Tomahawk land attack cruise missiles by the US Navy guided missile destroyers USS *Laboon* (DDG 58) and USS *Higgins* (DDG 76), the guided missile cruiser USS *Monterey* (CG 61) and the nuclear attack submarine USS *John Warner* (SSN 785). In addition, 19 AGM-158A Joint Air-to-Surface Stand-off Missiles (JASSM) were launched from B-1B Lancers. The use of JASSM, which has a range of more than 200nm (370km), marked the missile's combat debut. Besides the three B-1Bs, 33 US aircraft that participated included eight F-15Cs from the 48th Fighter Wing's 493rd Fighter Squadron, eight F-16Cs from the 31st FW, three KC-10A and 10 KC-135R/T tankers. Additional support was provided by USAF RC-135s and unmanned RQ-4Bs, and at least one US Marine Corps EA-6B Prowler.

Four RAF Tornado GR4s from 903 Expeditionary Air Wing (EAW) at RAF Akrotiri, Cyprus, delivered eight MBDA Storm Shadow cruise missiles against the Him Shinsar chemical weapons storage facility 15 miles (28km) west of Homs. The site was also struck by nine Tomahawks, three naval and two air-launched SCALP missiles launched from Rafale fighters that operated from their base in France. RAF Typhoon FGR4s and French Mirage 2000 fighters reportedly supported the mission. The Barzah scientific research, development and production center near Damascus was struck by 57 Tomahawks and the JASSMs that destroyed the facility.

AESA RADAR FOR MARINE HORNETS

THE US MARINE Corps is moving ahead with plans to replace the radar installed in its F/A-18C/D fighters with a new active electronically scanned array (AESA) system. Naval Air Systems Command (NAVAIR) issued a request for information (RFI) on March 20 associated with a replacement for the Hornet's current Raytheon AN/APG-73 radar. This is intended to alleviate ongoing maintainability, supportability and readiness issues. In addition, the AESA will provide associated capability improvements. NAVAIR plans to issue a contract this October with retrofits beginning in late 2020 and running through late 2022. A total of 98 AESAs will be procured for installation in 12 aircraft assigned to each of seven fleet squadrons, along with 14 spare systems. Chief among the requirements for the project is that installation should not require changes to the current radar-aircraft interfaces. Raytheon is expected to offer a variant of the Super Hornet's AN/APG-79 radar while Northrop Grumman will likely propose the AN/APG-83 Scalable Agile Beam Radar (SABR). The latter system will be installed in up to 72 Air National Guard F-16Cs.

The Marine Corps is working hard to address readiness issues in its Hornet fleet. **Jamie Hunter**



Lockheed Martin's newly revealed MQ-25 Stingray concept. **Lockheed Martin**

LOCKHEED MARTIN STINGRAY CONCEPT REVEALED

LOCKHEED MARTIN RECENTLY revealed its concept for the US Navy's MQ-25A Stingray unmanned carrier-based aerial refueling aircraft. Developed by the company's 'Skunk Works', the tail-less flying wing design was apparently solidified in mid-2017 and includes at least two external hardpoints located on either side of the fuselage centerline.

Although Lockheed Martin has not built a flying prototype, its design for the MQ-25A includes a single non-afterburning General Electric F404 turbofan. The engine, which already powers the Hornet as well as several other manned and unmanned aircraft, will be adapted for the Stingray and will deliver around 10,000lb (44.48kN) of thrust. The flying wing design will be capable of a cruise speed of about Mach 0.7.

Lockheed Martin has also revealed that Triumph Group's aerostructures division will be the lead designer and supplier of internal structures for the Stingray. The contractor had previously announced that it will use the F-35C landing gear for the UAS, which is produced by UTC Aerospace Systems.

In related news, Boeing Phantom Works and General Atomics have both revealed which engines will power their Stingray designs. Boeing's T-1 prototype entry, which is already undergoing testing in St Louis, Missouri, is powered by a variant of the Rolls-Royce AE3007 turbofan, which powers the USAF's RQ-4B and the Navy's MQ-4C high-altitude UAS. The contractor has already conducted engine runs at both low power and high power in different conditions. Although Boeing has not flown the prototype it has demonstrated functionality with the air vehicle's software, mission computer and vehicle management system.

General Atomics Aeronautical Systems, the third competitor for the MQ-25, has begun full-scale testing of the newly certified Pratt & Whitney Canada PW815 high-bypass turbofan, which it selected to power its MQ-25A design.

All three contractors submitted proposals for the Stingray in early January. A source-selection decision is expected sometime between August and October.

The navy is currently conducting the competitive source selection portion of the MQ-25 program. It requested $719 million for Stingray development in its Fiscal Year 2019 budget and plans on buying the first four engineering and manufacturing development (EMD) air vehicles in 2023, with the MQ-25A achieving initial operational capability in 2026. The navy's basic requirements for the Stingray include the delivery of 15,000lb (6,804kg) of fuel 500nm (926km) from the host aircraft carrier.

This image: The commanding officer of VMFA-122 'Flying Leathernecks' conducts the squadron's first F-35B mission on March 29, 2018. **USMC/Sgt Allison Lotz**

Far right: F-35C test aircraft CF-02 touches down at NAS Patuxent River, Maryland, at the conclusion of the Joint Strike Fighter program's final system development and demonstration flight on April 11, 2018. The flight was the 596th for the aircraft, which first flew on April 29, 2011, and was intended to collect loads data while carrying four external 2,000lb (907kg) GBU-31 Joint Direct Attack Munitions (JDAM) and AIM-9X air-to-missiles. **Lockheed Martin**

TRITON PLANS

THE US NAVY plans to deploy its first two MQ-4C high-altitude unmanned intelligence, surveillance and reconnaissance (ISR) aircraft and will achieve early operational capability (EOC) when they begin flying operational missions by the end of this year. The Tritons will be forward-based at Andersen AFB, Guam.

Although the aircraft will not achieve initial operational capability (IOC) until 2021, they will initially be deployed with a multi-sensor mission payload that includes electro-optical/infra-red (EO/IR) sensors, a radar and automatic identification system (AIS) and an electronic support measures system that enable it to conduct maritime ISR. The configuration, which is known as integrated functional capability-3 (IFC3), is undergoing operational assessment. Data collected by the Triton will be relayed to one of two main operating bases or airborne P-8A Poseidon multi-mission maritime aircraft.

The MQ-4C will achieve IOC after a second pair of aircraft has been fielded, enabling the navy to maintain one 24-hour, seven-day orbit. Beginning in 2020, IFC4 series aircraft will receive a signals intelligence (SIGINT) capability that will replace the EP-3E aircraft. Testing of the IFC4 configuration will begin in 2019. Under the navy's concept of operations, one MQ-4C will be on station over an area of interest while one is en route to its orbit and another is returning to base. The fourth aircraft will be undergoing routine maintenance. Once the MQ-4C achieves full operational capability, the fleet will conduct five worldwide four-aircraft orbits.

The MQ-4Cs will be flown from five operating bases that comprise NAS Sigonella, Italy, Naval Station Mayport, Florida, Naval Base Ventura County-Point Mugu, California, and an unspecified location in the Middle East. The main operating bases will be located at NAS Jacksonville, Florida and NAS Whidbey Island, Washington. The initial aircraft will be assigned to unmanned patrol squadron VUP-19 at Jacksonville. A second unit will be formed at NAS Whidbey Island when VUP-11 is activated in 2019. When FOC is achieved, VUP-19 and VUP-11 will be responsible for controlling three and two worldwide orbits.

CARRIER NEWS

THE AIRCRAFT CARRIER USS *Theodore Roosevelt* (CVN 71) and the ships of carrier strike group CSG- 9 departed the US 5th Fleet area of operations (AOO) after more than four months of operation in the Middle East and entered the US 7th Fleet AOO in the Indian Ocean in late March. While attached to the 5th Fleet, the group supported Operations 'Inherent Resolve' (OIR) and 'Freedom's Sentinel' (OFS), and the aircraft assigned to CVW-17 launched more than 1,000 sorties in support of those efforts.

The USS *Harry S. Truman* (CVN 75) departed Naval Station Norfolk, Virginia, for a scheduled deployment on April 11. Aircraft assigned to CVW-1 are embarked aboard the carrier as well as the strike group's aviation-capable escorts. During the deployment, the strike group will support maritime security operations and will deploy to the US 5th and 6th Fleet areas of responsibility.

The USS *Carl Vinson* (CVN 70) returned to NAS North Island in Coronado, California, at the conclusion of a three-month deployment to the Indo-Pacific region that included a port call in Vietnam. *Vinson*'s arrival in Da Nang marked the first time that a US aircraft carrier had visited the country in more than 40 years.

PARAMOUNT TO SUPPORT DRAKEN INTERNATIONAL MIRAGE FLEET

DRAKEN INTERNATIONAL HAS selected Paramount Aerospace Systems to refurbish 22 ex-Spanish Air Force Mirage F1M and F1B fighters that were purchased from the Spanish government. The South African contractor will reassemble the aircraft, restore them to airworthy status and conduct airworthiness certification at Draken's Lakeland, Florida, maintenance facility. Draken acquired the Mirages to enhance its ability to provide adversary services for the US Department of Defense and allied nations. Paramount previously equipped the former Spanish Mirage F1Ms with a full radar and avionics suite modernization in the late 1990s. Draken also purchased 12 radar-equipped Denel Cheetah fighters from South Africa.

LIGHTNING II LATEST

VMFA-122 RE-FORMS • US NAVY CARRIER QUALS

MARINE STRIKE FIGHTER squadron VMFA-122 conducted its first mission as an F-35B unit at MCAS Yuma, Arizona, on March 29. Known as the 'Flying Leathernecks', the squadron is the third operational Marine Corps unit to transition to the F-35B, having begun its conversion from the F/A-18C in October 2017. As part of the process, VMFA-122 relocated from MCAS Beaufort, South Carolina, to Yuma.

In related news, VMFA-121 'Green Knights' loaded live GBU-32 1,000lb (454kg) Joint Direct Attack Munitions (JDAMs) onto an F-35B aboard the amphibious assault ship USS *Wasp* (LHD 1) on March 24. The milestone marked the first time that live munitions have been loaded on to a Lightning while under way during an operational deployment.

Naval aviators assigned to VFA-101 'Grim Reapers' and VFA-125 'Rough Raiders' conducted carrier qualifications (CQ) aboard the USS *Abraham Lincoln* (CVN 72), which was under way in the Atlantic Ocean, from March 17-21. The pilots made a total of 140 arrested landings during both day and night qualification missions. Integration of the F-35's Autonomic Logistics Information System (ALIS) with *Abraham Lincoln* was also evaluated during the CQ period.

The 'Argonauts' of VFA-147 are on schedule to complete conversion to the F-35C in October. The squadron's transition to the Lightning II began in January 2018 and its personnel are undergoing training at Eglin AFB, Florida, and NAS Lemoore, California. The US Navy has also now confirmed plans to field an unconfirmed number of F-35Cs to MCAS Iwakuni, Japan, sometime after 2021. The aircraft will replace F/A-18E/Fs with one of the four squadrons that operate from the aircraft carrier USS *Ronald Reagan* (CVN 76) as part of Carrier Air Wing CVW-5.

PRESIDENTIAL HELICOPTER MAKES PROGRESS

THE FIRST TWO VH-92A engineering development models (EDM) are being prepared for hand-over to the US Navy this summer. The aircraft, which respectively flew for the first time in July and November 2017, are currently at Lockheed Martin's Owego, New York, facility where they are being painted and having their interiors installed. Both EDMs will support an operational assessment that will be conducted by Marine helicopter squadron HMX-1 and will validate and verify the helicopter's unique requirements.

Development of the VXX presidential helicopter began in May 2014, when the US Navy awarded the $1.2-billion contract to Sikorsky Aircraft, which is now part of Lockheed Martin. In addition to the SDD aircraft it provided for four VH-92A system demonstration test article (SDTA) aircraft and associated support equipment, and included production options. Ultimately the program includes 17 production aircraft, making for a fleet of 21 operational and two test helicopters. Under current plans the initial group of six low-rate initial production helicopters will be purchased in 2019 with the remaining 11 following in 2020 and 2021.

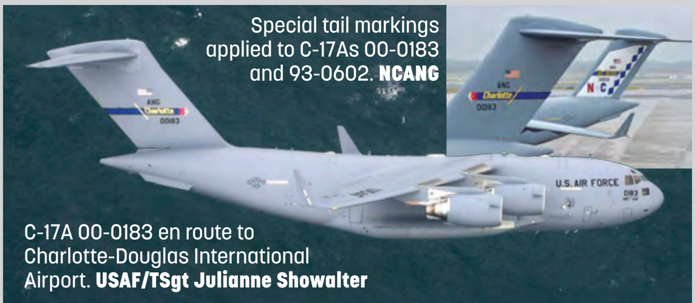
The four SDTAs are being transformed from S-92As into VH-92As by Sikorsky at its Stratford, Connecticut, facility. All four will be fully configured for the mission and will be delivered in summer 2019.

SNEAKY DASH

Seen arriving at RAF Mildenhall on April 6 is DHC-8-202 N8200R, callsign 'Grizzly 46', thought to be owned by Dynamic Aviation (Dynamic Avlease). It's one of two examples operated for special mission roles by the company. **Ryan Dorling**

SUPER HERCULES TO REPLACE 'FAT ALBERT'

NAVAL AIR SYSTEMS Command (NAVAIR) plans to purchase one of 10 C-130Js acquired from the Royal Air Force as a replacement for the C-130T support aircraft operated by the US Navy Flight Demonstration Squadron, the Blue Angels. The Hercules has been grounded since a US Marine Corps variant crashed in July 2017. The UK, which originally acquired 10 C-130Js and 15 stretched C-130J-30 variants that are respectively operated under the designations Hercules C5 and Hercules C4, intends to retire the former while retaining the latter. It has already reportedly sold two of the C5s to Bahrain. Acquisition of the C-130J is intended to avoid a gap in logistical support of the flight demonstration squadron.



Special tail markings applied to C-17As 00-0183 and 93-0602. **NCANG**

C-17A 00-0183 en route to Charlotte-Douglas International Airport. **USAF/TSgt Julianne Showalter**

CHARLOTTE'S FIRST GLOBEMASTER IIIs ARRIVE

THE NORTH CAROLINA Air National Guard's 145th Airlift Wing commemorated its transition from the C-130H to the C-17A during a formal arrival ceremony for the Globemaster III at Charlotte-Douglas International Airport on April 7. Two C-17As arrived at the North Carolina base from Joint Base Charleston, South Carolina, flown by crews from the 156th Airlift Squadron. While en route to Charlotte the C-17As conducted a flight over the Wright Brothers National Memorial at Kill Devil Hills, North Carolina. The 145th Airlift Wing celebrated the 70th anniversary of its activation on March 15, 2018. Appropriately, one of the C-17As was given special tail markings to mark the milestone.

The second KC-46A takes fuel from the fifth example during recent testing. Some 146,000lb (66,224kg) of fuel was transferred between the two aircraft. **Boeing/John Parker**

KC-46A HITS TEST MILESTONE

FAA CERTIFICATION COMPLETE

FIRST SLM SUPER HORNET INDUCTED

THE FIRST US Navy F/A-18F to be inducted into the service life modernization (SLM) program arrived at Boeing's St Louis, Missouri, facility adjacent to Lambert International Airport on April 5. F/A-18F BuNo 166619 was last assigned to VFA-106 at NAS Oceana, Virginia. The modifications will initially increase the Super Hornet's service life from 6,000 to 7,500 hours, but it will be further pushed to 9,000 hours after 2022. Although the initial SLEP mod will require 18 months, Boeing expects to reduce the production time to around 12 months and will upgrade 40-50 Super Hornets annually at its St Louis and San Antonio, Texas, facilities. Six aircraft will be inducted at St Louis before the first example arrives at the Kelly Field facility in San Antonio during 2019. Block III will first be introduced in new production aircraft in 2020 and Boeing will begin upgrading the Block II Super Hornet airframes in 2022.

In addition to upgrading the fighter's Raytheon AN/APG-79 active electronically scanned array (AESA) radar, Block III will add the AN/ALQ-214 integrated defensive electronic countermeasures (IDECM) Block IV suite and the Lockheed Martin AN/ASG-34 infra-red search and track pod as well as tactical targeting networking technology (TTNT) that will allow it to transfer more data. Additionally, conformal fuel tanks will increase range by 100-120nm (185-222km).

Boeing delivered 147 Block I Super Hornets, comprising 64 F/A-18Es and 83 F/A-18Fs, before deliveries of Block II variants began in October 2002. The service's program of record includes 584 Super Hornets and Boeing has delivered more than 570 examples. The navy's inventory featured 284 F/A-18E and 257 F/A-18F models in December 2017. The recently approved Fiscal 2018 spending bill included funding for 24 Super Hornets, and the Trump administration plans to buy 110 additional fighters from fiscal 2019 to 2023.

E-2D REFUELING CAPABILITY GAINS SPEED

NORTHROP GRUMMAN IS moving forward with a program that will make the US Navy's E-2D fleet capable of being refueled in flight. Operational testing of the new capability, which will increase the Advanced Hawkeye's mission duration from four to seven hours and double its time on station to five hours, is expected to begin in 2019. Three test aircraft are now flying and the fourth and fifth modified aircraft will respectively be delivered by mid-year and year-end.

The initial modified E-2D first received fuel via the probe-and-drogue method from a KC-130J in July 2017. Subsequent tests with the KC-135 followed in October 2017, an F/A-18 in December 2017, and most recently with a KC-10A in January. The E-2D also has been fully qualified to receive fuel from the Omega Air Refueling KC-707. The program is conducting envelope expansion with each of the tankers.

E-2Ds equipped with the modification are expected to achieve initial operational capability in 2020. Although production modifications will begin with the 46th new-build aircraft, the system will be retrofitted to earlier models at a cost of around $6 million each. The upgrade requires modifications to the cockpit, flight software, rudder, fuel system, wing center section fuel tank and external lighting. The US Navy has a requirement for 75 E-2Ds and Northrop Grumman has delivered 32 to date. E-2Ds are operational with three squadrons and the new variant is expected to completely replace the earlier E-2C by 2027.

JAYHAWK SLEP APPROVED

THE US COAST Guard received approval from the Department of Homeland Security on February 20 for the next phase of a service life extension program (SLEP) for its fleet of 45 MH-60T medium-range recovery helicopters. The program will ensure that the Jayhawks can remain in service until around 2030. A previous SLEP added 10,000 flight hours to the airframes. In addition to providing the Jayhawks with a further 10,000-hour life extension, the coast guard is considering converting retired HH-60H and SH-60F hulls to MH-60T configuration. The service's Aviation Logistics Center (ALC) in Elizabeth City, North Carolina, has already converted six SH-60Fs to the Jayhawk configuration.

BOEING AND THE US Air Force recently completed supplemental type certification (STC) fuel on-load testing with the KC-46A Pegasus. The milestone occurred when one KC-46A transferred 146,000lb (66,224kg) of fuel to another at a maximum flow rate of 1,200lb/min during a flight conducted from Boeing Field. During the STC testing, the Pegasus also demonstrated its ability to receive fuel from a KC-135 and KC-10. In the course of 68 contacts the Pegasus received 540,600lb (245,212kg) of fuel.

The KC-46A program has now completed 2,700 flight hours and made more than 2,500 contacts refueling contacts with F-16, F/A-18, AV-8B, C-17, A-10, KC-10, and KC-46 aircraft.

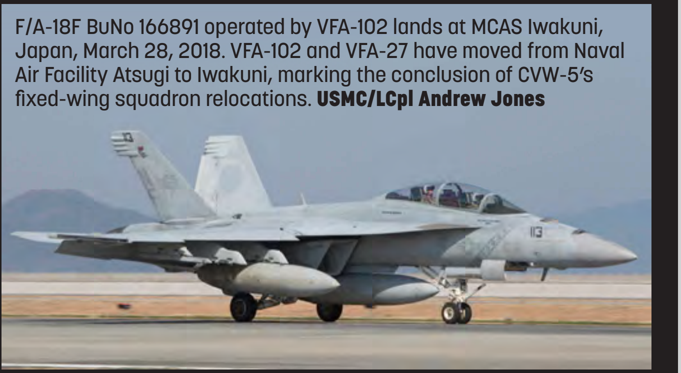
MILITARY AVIATION GAINS UNDER SPENDING BILL

ALMOST SIX MONTHS into the fiscal year the US government finally approved the 2018 spending bill, which was signed into law by President Trump on March 23. The $1.3-trillion budget provided $700 billion for national defense, which represented a $61-billion increase over 2017 and was the largest rise in 15 years. Pentagon appropriations include $589.5 billion in the base budget and $65.2 billion in the overseas contingency operations (OCO) budget.

Aviation accounts received a 28 per cent increase over the president's 2018 request totaling $19 billion, providing for the purchase of 143 additional aircraft. These include six C-130Js for the Air National Guard and a pair of C-37Bs to partially replace five USAF C-20Bs that have been retired.

The bill also provides an extra $455 million for aviation spares and repair parts to address maintenance and readiness issues. In addition to $144 million for C-130 aircraft modifications and $40 million for F-16 radar upgrades, funding was included to restart the production of new wings for the 109 A-10Cs that have not yet received replacements.

UNIT NEWS



F/A-18F BuNo 166891 operated by VFA-102 lands at MCAS Iwakuni, Japan, March 28, 2018. VFA-102 and VFA-27 have moved from Naval Air Facility Atsugi to Iwakuni, marking the conclusion of CVW-5's fixed-wing squadron relocations. **USMC/LCpl Andrew Jones**

24th TASS activated

The USAF reactivated the 24th Tactical Air Support Squadron (TASS) at Nellis AFB, Nevada, on March 2. The unit, which is equipped with Block 40 F-16C/Ds, is primarily tasked with training, supporting and performing close air support. Among its missions, the 24th TASS will focus on training joint terminal attack controllers (JTAC) and flying support missions for multiple USAF Weapons School weapons squadrons. The unit is a component of the 57th Wing's CAS Integration Group.

Ospreys arrive at Yokota

The USAF has accelerated its plans for fielding CV-22B tilt-rotors to Japan and five of the aircraft arrived at Yokota Air Base near Tokyo on April 5. The Ospreys arrived as 'Knife 31 flight' after being off-loaded from a vehicle carrier in Yokohama.

Air Force Special Operations Command (AFSOC) had planned to deploy the first of 10 Ospreys to Yokota in 2020 but moved forward with its plans to address regional security concerns, 'in line with the recently released 2018 National Defense Strategy.' Around 100 personnel will initially accompany the Ospreys, which will conduct training throughout the Pacific Command area of responsibility over the coming months. Ten CV-22Bs and 450 personnel will ultimately be stationed at Yokota as part of the phased-basing plan. The five Ospreys will start by performing training in the North-east Asia, Indo-Pacific region. The USAF expects to formally activate the CV-22B unit in Japan 'sometime this fall.'

Navy Gulfstream retired

The first of five C-20Gs operated by the US Navy was retired when BuNo 165093 arrived at Davis-Monthan AFB, Arizona, on February 21. The Gulfstream IV had been operated by fleet logistic support squadron VR-51 at MCAS Kaneohe Bay, Hawaii, which is preparing to convert to the larger C-40A Clipper.

Atsugi moves complete

F/A-18Es and F/A-18Fs operated by strike fighter squadrons VFA-27 and VFA-102 arrived at MCAS Iwakuni, Japan on March 28, completing their home port change from NAF Atsugi near Tokyo. The arrival of the 'Royal Maces' and the 'Diamondbacks' completed the phased relocation of the CVW-5's fixed-wing aircraft from central to southern Honshu. The process was conducted under the Defense Program Review Initiative (DPRI) and supports the navy's strategic vision for the Indo-Pacific region.

Combat King II delivered

Lockheed Martin delivered the first of four new HC-130J combat search and rescue tankers to the California Air National Guard's 129th Rescue Wing at its Marietta, Georgia, facility on April 5. The Hercules subsequently departed for its new home base at Moffett Federal Airport in Sunnyvale, California, the following day. At present the wing's 130th Rescue Squadron operates a fleet of MC-130P Combat Shadow aircraft, and the first of those was retired to Sheppard AFB, Texas, on March 21. There it will be used as a ground-based trainer aircraft by the 362nd and 363rd Training Squadrons.

Final 'classic' Hornet deployment

Strike fighter squadron VFA-34 quietly completed the US Navy's final F/A-18C deployment when it returned to NAS Oceana, Virginia, on April 11. The 'Blue Blasters' Hornets left Oceana in January for deployment with carrier air wing CVW-2 aboard the USS *Carl Vinson* (CVN 70). During the course of the three-month deployment VFA-34 flew 653 sorties and logged more than 1,044 flight hours. The squadron will be the last to convert to the Super Hornet when it begins its conversion to the F/A-18E.

HC-130J serial 15-5842 departs Dobbins Air Reserve Base, Georgia, at the start of its delivery flight to Moffett Federal Airport, California, on April 6. The Super Hercules is the first of four that will be assigned to the California Air National Guard's 129th Rescue Wing. **Thinh Nguyen**

LIBERTY MC-12 ON THE MOVE

USAF MC-12W serial 09-0661 taxiing for departure from Prestwick Airport, Scotland, on April 5 following a night stop after arriving from Aviano, Italy, along with fellow MC-12W 09-0681 on April 4. Both are believed to be operated by the Oklahoma Air National Guard's 185th Special Operations Squadron. **Niall Paterson**

NEW PROPELLERS FOR NAVY HERCS

THE US NAVY is accelerating plans to replace the propellers on its fleet of 24 C/KC-130Ts after receiving $121 million that was included in the recently approved Fiscal 2018 spending bill. The program had been included in the navy's Fiscal Year 2019 unfunded priorities list. It will replace the C-130T's current four-blade Hamilton Sundstrand 54H60 series propellers with eight-blade UTC Aerospace Systems NP2000 models. The NP2000 is already installed on US Navy E-2C/D and C-2A aircraft. The navy grounded 21 of its C-130Ts due to propeller problems after a US Marine Corps KC-130T crashed in July 2017. Replacement of the propeller systems will take 12 and 18 months to complete. The USAF is installing the NP2000 on several C-130Hs operated by the Air National Guard and testing has already been completed on that model. The KC/C-130T is based on the C-130H.

STAMP UPGRADES PLANNED

US SPECIAL OPERATIONS Command is upgrading its forward-based SOCOM Tactical Airborne Multi-Sensor Platforms (STAMP) aircraft. The fleet of government-owned contractor-operated (GOCO) aerial intelligence, reconnaissance and surveillance (AISR)-collection aircraft includes two King Air 350s, one King Air 350ER and two DHC-8-202s. For the STAMP King Airs the upgrades feature the installation of a tag, track and locate (TTL) capability, GPS anti-jam hardening for the mission equipment and aircraft flight management system (FMS), TinCup SIGINT payload, a video encoder upgrade, and replacement of the encryption system. The Dash 8 upgrade includes GPS anti-jam hardening. The STAMP project is managed by the US Army's project manager, sensors-aerial intelligence (PM SAI).

'BULLDOGS' HEAD EAST

A dozen F-16CMs operated by the 179th FS 'Bulldogs' of the 148th FW, Minnesota ANG arrived at Morón Air Base, Spain, on April 11 heading eastbound on deployment. The aircraft comprised serials 91-0336, 91-0339, 91-0341, 91-0349, 91-0388, 91-0391, 91-0405, 91-0408, 91-0409, 91-0414, 91-0420 and 91-0421. **Antonio Muñiz Zaragüeta**

DEPLOYMENT NEWS

B-1s in Middle East

A pair of B-1Bs arrived at Al Udeid Air Base in Qatar on March 31, marking the first time since 2016 that the bomber has been deployed in support of US Air Forces Central (AFCENT). The Lancers, which are assigned to the 28th Bomb Wing at Ellsworth AFB, South Dakota and flown by the 34th Expeditionary Bomb Squadron, flew their first operational mission on April 8. B-52Hs from the 69th Expeditionary Bomb Squadron have been supporting combat operations in Afghanistan, Iraq and Syria as part of the 379th Air Expeditionary Wing since April 2016.

Oregon Eagles in Europe

Six F-15Cs operated by the Oregon Air National Guard's 142nd Fighter Wing arrived at Leeuwarden Air Base, the Netherlands on March 15. A second cell of six fighters from the Massachusetts Air National Guard's 104th Fighter Wing followed on March 19. While deployed in support of Operation 'Atlantic Resolve' (OAR) as part of the Theater Support Package (TSP), the 123rd Expeditionary Fighter Squadron (EFS) will participate in the 'Frisian Flag 2018' exercise in the Netherlands and will conduct training deployments to RAF Lakenheath, UK and Graf Ignatievo Air Base in Bulgaria.

'Thunderbolts' head home

The 'Thunderbolts' of Marine fighter attack squadron VMFA-251 completed a deployment to MCAS Iwakuni, Japan, and departed for their home station at MCAS Beaufort, South Carolina, on March 17. The squadron arrived at Iwakuni on September 2017 as part of the unit deployment program (UDP) and was attached to Marine aircraft group MAG-12. VMFA-251 was replaced by Marine all-weather fighter attack squadron VMFA(AW)-533. The 'Hawks' arrived at Iwakuni from Beaufort with eight F/A-18Ds on March 15.

'Mad Foxes' complete deployment

VP-5 'Mad Foxes' returned to NAS Jacksonville on April 10 after a six-month deployment in support of the US 4th and 6th Fleets. While deployed to NAS Sigonella, Italy and Comalapa International Airport, El Salvador, the squadron's P-8As flew more than 4,150 hours conducting intelligence, surveillance and reconnaissance flights, relief, counter-drug and anti-submarine warfare missions.

'Fighting Marlins' complete P-3 mission

VP-40 'Fighting Marlins' completed its final P-3C Orion deployment and returned to NAS Whidbey Island, Washington, in mid-April.

An F/A-18C operated by Marine fighter attack squadron VMFA-251 taxiing at MCAS Beaufort, South Carolina, upon returning from a deployment to Japan on March 22. The 'Thunderbolts' had been in Japan as part of the Unit Deployment Program. **USMC**

AIRCRAFT • SQUADRONS • MISSIONS • PERSONNEL • PROGRAMS

The third edition of the US Air Force Air Power Yearbook comes at a time when readiness is at the forefront of the concerns for USAF leaders. It's a word that has many influencing factors, not least manpower — the USAF says it is short by nearly 2,000 pilots — hardware, funding, the list goes on.

One of the ways the USAF is looking to retain and 'absorb' more pilots is through OA-X or light attack. This could see the USAF at long last buying a fleet of low-cost, light attack aircraft to operate in low threat environments in support of ground forces in the close air support role.

In this 100-page 2018 yearbook we also feature the B-1B Lancers of Ellsworth AFB, the 'High Rollers' of the Nevada Air National Guard and their C-130 mountain flying training school, a look at USAF contracted Red Air plans, plus the F-35A Lightning's global presence — all of this plus a full rundown of all USAF aircraft types and units.

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STRIKING **SYRIA**

In the early hours of April 14, a joint cruise missile attack targeted three sites in Syria in response to the use of chemical weapons in Douma. A total of 105 cruise missiles were launched during an operation that involved 66 combat aircraft from the US, France and the United Kingdom.

REPORT **Babak Taghvaee**

A SUSPECTED CHEMICAL ATTACK in the Syrian city of Douma on April 7 reportedly killed at least 70 people. The US government quickly attributed the atrocity to the Syrian Arab Army, while the Syrian government and its allies claimed it had been carried out by rebels — some suggesting it was a 'false flag' operation to put Syria under political pressure. The US, France and UK claimed to have evidence showing the direct role of Syrian government forces in the attack, which was apparently aimed at the Jaysh al-Islam group (designated as a terrorist organization by Syria, Russia and Egypt).

To punish the Syrian government for its use of weapons of mass destruction, the US apparently decided as early as April 8 to carry out a strike against the Syrian Arab Army with the aim of eliminating its chemical weapons capability. France and the UK joined the alliance on April 12.

Below: A 34th Expeditionary Bomb Squadron B-1B deployed to the 379th Air Expeditionary Wing prepares to launch from Al Udeid to attack targets in Syria. Two Lancers, deployed from Ellsworth AFB, South Dakota, employed 19 JASSM-ERs, marking the first combat employment of the weapon. **USAF/MSgt Phil Speck**

Left: An RAF Tornado GR4 taxiing into its hangar after landing at Akrotiri on completing its mission. The four Tornados that conducted strikes in Syria were flown by No 31 Squadron 'Goldstars'. **Crown Copyright**

It seems Washington's initial plans envisaged a large-scale strike against three Syrian Arab Air Force (SyAAF) air bases: Dumayr, al-Shayrat and T4/Tiyas using BGM-109C Tomahawk land attack missiles (TLAMs) launched by the Arleigh Burke-class guided-missile destroyer USS *Donald Cook* (DDG 75) in the eastern Mediterranean and another destroyer in the Red Sea.

According to the Russian Ministry of Defense (MoD), the US and Russian governments secretly discussed the proposed cruise missile strike on April 9, and Moscow warned the US that it would retaliate against such an operation. Meanwhile, in the early hours of the same day, four Israeli Air Force (IAF) F-16Is — or F-15Is, according to Russian accounts — launched eight Delilah cruise missiles against T4/Tiyas. The target was the unmanned aerial vehicle (UAV) operations of the Islamic Revolutionary Guard of Corps Aerospace Force (IRGCASF), including a command and control site and equipment including Saeghe UAVs and armed Shahed-129 drones. The raid reportedly resulted in the deaths of at least eight Iranian personnel.

The SyAAF was now on high alert and began to evacuate its mission-capable jets from T4 and other air bases. These included all 10 airworthy Su-24Ms of the 819th Squadron, which were sent to the Russian Air Force's Hmeimin airfield in Latakia and other bases close to the Russian S-400 surface-to-air missile (SAM) battery, such as Kuweires in Aleppo.

Russian activity

On April 8, a pair of Russian Su-24Ms flying at very low altitude, and escorted by a pair of Su-30SMs, buzzed the French Navy frigate *Aquitaine* (D650) in the eastern Mediterranean. The Russian Air Force also staged continuous combat

Above: French Air Force C-135FR serial 470 took part using the callsign 'FAF4042'. **Mark Rourke**

Left: A USAF B-1B Lancer is refueled by a KC-10A Extender over an undisclosed location in the Middle East on April 14, the day of the cruise missile strikes. **USAF/TSgt Lynette Hoke**

air patrol (CAP) missions using pairs of Su-30SMs on April 8-9. These overflew the Syrian coastline, especially around the Russian Navy base at Tartus.

On April 11 the Russian military began a two-day naval exercise involving most of its assets in Tartus. A Russian Navy Il-38N flew a maritime surveillance mission while unarmed Su-24Ms and Su-34s armed with Kh-35 anti-ship missiles were supported by a pair of Su-30SMs and an A-50 airborne early warning (AEW) aircraft. The Russian MoD now warned that its warships would shoot down any cruise missiles launched against Syrian targets by the US Navy.

The US Navy's 6th Fleet used four of seven P-8A Poseidons and one of two P-3C AUP Orions available at Naval Air Station Sigonella, Italy to monitor the exercise and protect US Navy assets in the Mediterranean.

Intelligence-gathering

Following the evacuation of T4/Tiyas and other SyAAF air bases after the IAF raid, the value of any strike against these facilities was much reduced. It would also have run the risk of escalating tensions with Russia — after all, the Russian Air Force has used Tiyas as a forward operating base.

Instead, the destruction of Syria's chemical weapons capability became the aim of the planned cruise missile strikes. The French and British governments then approved the plan for a cruise missile strike and announced their intention to join the US-led operation.

The US Air Force reportedly conducted a significant intelligence-gathering operation to plan an effective strike. This seems to have involved various assets including one of three U-2S spyplanes of the 99th Reconnaissance Squadron (RS) at RAF Akrotiri, Cyprus and two RQ-4Bs belonging to the 12th RS deployed at Sigonella.

On April 12, the Royal Air Force's No 5 (Army Co-operation) Squadron forward-deployed one of its four Sentinel R1s to Akrotiri. The aircraft flew an intelligence-gathering mission the next day, allegedly reconnoitering the target sites using its ASARS-2A sensor.

Cruise missile launches

The French Navy strike group in the eastern Mediterranean consisted of one Cassard-class destroyer, one Georges Leygues-class frigate, one Durance-class tanker, and the FREMM multi-purpose frigates *Aquitaine* (D650), *Auvergne* (D654) and *Languedoc* (D653).

On April 14, the FREMM vessels fired three Missile de Croisière Naval (MdCN) land attack missiles at the weapons storage facility in the Him Shinshar chemical weapons complex, a former SyAAF missile base 9.3 miles (15km) west of Homs. Operating in the same area, the US Navy's Virginia-class submarine USS *John Warner* (SSN 785) launched six Tomahawks at weapons bunkers at Him Shinshar.

Nine fighters also launched cruise missiles at these two sites near Homs. These included three Rafale Bs of EC 1/4 'Gascogne' and two Rafale Cs of ETR 3/4 'Aquitaine', all from Saint-Dizier. The Rafales launched 10 SCALP EG cruise missiles. Two missiles hit the weapons storage site west of Homs, seven hit the weapons bunkers in the east and one

Below: A pair of French Air Force Rafales departs Saint-Dizier on the night of the attacks, armed with SCALP EG cruise missiles. **French Ministry of Defense**

came down in the eastern Mediterranean due to a technical failure.

Minutes after the French Rafales dropped their weapons, four RAF Tornado GR4s flying from Akrotiri launched eight Storm Shadow cruise missiles that hit the storage site west of Homs.

From the US 5th Fleet area of operations in the north of the Red Sea, seven Tomahawks were fired from the US Navy Arleigh Burke-class destroyer USS *Laboon* (DDG 58) and 30 more from the Ticonderoga-class cruiser USS *Monterey* (CG 61). The BGM-109s flew over the Israel/Jordan border until they entered Syrian airspace in the Golan Heights. They hit the three drug research laboratories of the Barzah scientific research center in the north of Damascus, where it was believed that chemical weapons were developed.

The Arleigh Burke-class destroyer USS *Higgins* (DDG 76) fired 23 further Tomahawks from the north of the Persian Gulf. Of these, 20 targeted the Barzah center and three the Him Shinshar storage site in the west of Homs.

Flying over the west of Iraq, two B-1Bs of the 37th Bomber Squadron (serials 86-0111 and 86-0129) launched 19 AGM-158B Joint Air-to-Surface Stand-off Missile — Extended Range (JASSM-ER) weapons at the Barzah center, logging the first operational use of this missile.

Counter-air missions

Given the possibility of aerial confrontation with Russian Su-30SM fighters armed with air-to-air missiles, Su-34s equipped with Kh-35 anti-ship missiles and Su-24Ms armed with other precision-guided weapons, the coalition conducted CAPs to secure the airspace over the international waters of the eastern Mediterranean.

The USAF used 10 493rd Fighter Squadron (FS) F-15Cs and several 555th FS F-16Cs, all flying from Aviano AB, Italy. These were supported by KC-135Rs and KC-10As over the Mediterranean during a mission of almost six hours. The F-15Cs had been deployed to Aviano a few days before the operation and returned to RAF Lakenheath on April 15. The fighters flew in three different cells. The first had two flights — one of four F-16Cs and the other with four F-15Cs — while the second comprised three F-16Cs and four F-15Cs, and the third consisted of four F-16Cs.

To carry out high-asset value combat air patrol (HAVCAP) and forward CAP (FORCAP) to protect French E-3Fs, C-135FRs, Rafale B/Cs and warships, the Armée de l'Air used four Mirage 2000-5Fs from EC 1/2 'Cigognes'.

The RAF employed four of its six Typhoon FGR4s based at RAF Akrotiri for CAP and HAVCAP missions over the eastern Mediterranean.

For command and control, two Armée de l'Air E-3Fs flew together with at least four C-135FRs on a nine-hour mission over the eastern Mediterranean. These AWACS monitored airspace and supported USAF and RAF assets as well as the French Air Force fighters. It is rumored that a single USAF E-3G, one of six forward-deployed to Al Dhafra AB, United Arab Emirates, supported the B-1Bs. The Lancers in turn had electronic warfare support from a single EA-6B of Marine Tactical Electronic Warfare Squadron (VMAQ) 2 — one of six

> “With the possibility of aerial confrontation with Russian Su-30SM fighters, the coalition conducted CAPs to secure airspace over the international waters of the eastern Mediterranean

Above: RC-135V Rivet Joint 64-14846 from the 379th Air Expeditionary Wing takes off from Al Udeid back in 2016. Flying from Crete, this particular aircraft probably aided the coalition by collecting real-time, on-scene electronic intelligence. **USAF/SrA Miles Wilson**

Below: An RAF Voyager about to take off from Akrotiri, Cyprus. Although the RAF described the mission as being 'in support' of the Tornado strikes, it seems Voyager KC2 ZZ343 was used twice to refuel the RAF's Typhoon FGR4s that were on CAP during the operation. **Crown Copyright**

Above: A French Air Force Rafale B crew returns to base at Saint-Dizier after the Syrian raid. **Armée de l'Air**

examples deployed to Ahmad al-Jaber AB in Kuwait.

A USAF RQ-4B flew a 22-hour mission over the eastern Mediterranean throughout the operation. This likely provided a live intelligence feed that could have been sent directly to the E-3G via datalink. An RC-135V Rivet Joint from the 38th RS flying from Souda Bay, Crete, was used for signals intelligence (SIGINT) while an RC-135U Combat Sent that deployed to Souda on April 8 presumably collected intelligence on threat radar emitter systems. It was noted flying south of Crete during the operation.

Tankers

Tanker support for the operation involved 24 refueling aircraft, among them 10 KC-135Rs, a KC-135T and six KC-10As from the USAF, six French C-135FRs, and a single RAF Voyager KC2.

The C-135FRs included four flying from Avord and two flying from Istres. The French Air Force fighters and AWACS were also refueled by two USAF KC-135Rs equipped with hose and drogue systems and belonging to the 351st Air Refueling Squadron (ARS), detached to Zaragoza, Spain.

To assist the three packages of F-15Cs and F-16Cs flying from Aviano, the USAF sent five KC-135Rs from the 351st ARS to the Italian base. These dragged the F-15s and F-16s into the central Mediterranean where they were handed over to three KC-10As that deployed to Souda on April 11. At least three more KC-10As of the 305th Air Mobility Wing (AMW), flying from Al Udeid, provided support to the pair of B-1Bs and the E-3G over Iraq and the northern Persian Gulf.

Four further KC-135R/Ts of the 351st ARS supported the operation directly from RAF Mildenhall. It is believed that they also refueled the F-15s and F-16s flying from Aviano during the operation.

Sending a message

According to the coalition, Syria's chemical weapons program was entirely neutralized after all 105 missiles hit their targets. The coalition also claimed that the Syrian Air Defense Force launched 40 SAMs at the cruise missiles, all of which missed. Meanwhile, the Russian MoD claims that Syria launched 112 SAMs including 29 from Buk-M2, 25 from Pantsir-S1, 21 from Kvadrat, 13 from S-125, 11 from 9K33 Osa, eight from S-200, and five from Strela-10 systems. It said that 103 cruise missiles were launched against six SyAAF bases, two Syrian SAM sites and a Syrian Army base, but that 71 were shot down and most targets survived unscathed.

Further investigation suggests that none of the cruise missiles had been intended to destroy air bases and all were launched at targets not heavily protected by Syrian or Russian SAM batteries.

As a result of the operation, it appears that the three drug research laboratories of the Barzah scientific research center in Damascus were completely destroyed after being hit by 57 Tomahawk and 19 JASSM-ER missiles, while the Him Shinshar chemical weapons complex storage site west of Homs was destroyed by eight Storm Shadows, nine Tomahawks, three MdCNs and two SCALP EGs. Finally, satellite images indicate the Him Shinshar chemical weapons complex bunker was destroyed by seven SCALP EGs.

The US, French and British governments claim that they sent a message to Syria by neutralizing its chemical weapons capability. On balance, while the operation may not have destroyed any valuable military sites, it was a strong signal to any country that might intend to use chemical weapons. Furthermore, it was a show of force by the US government to Moscow, which has continued to support the Assad regime despite its indiscriminate use of weapons in civilian areas.

Below: F-15C serial 86-0165 returns to Aviano after flying a CAP for the operation. This is one of 10 Eagles from Lakenheath's 48th Fighter Wing that were forward-deployed to the Italian base in the days beforehand. **Silvani Mainini**

F-16C Block 40 serial 87-0351 recovers to Aviano. Each of the CAP F-16Cs was armed with four AIM-120Cs, two AIM-9X, an AN/ALQ-131 countermeasures pod and a Sniper targeting pod. **Claudio Tramonin**

THREE MORE LIGHTNING IIs FOR AUSTRALIA

FIRST RAAF JETS DELIVERED WITH BLOCK 3F SOFTWARE

RAAF POSEIDON ACHIEVES IOC

THE P-8A MULTI-MISSION maritime aircraft (MMA) has achieved initial operating capability (IOC) with the Royal Australian Air Force (RAAF), five months ahead of schedule. Announced on March 20, the milestone was achieved after six of the 12 aircraft that are currently under contract had entered service with 92 Wing's No 11 Squadron at RAAF Base Edinburgh in South Australia. The squadron received its first Poseidon in November 2016.

The RAAF is replacing its fleet of 19 AP-3C maritime patrol aircraft with 15 P-8As that will operate alongside seven Northrop Grumman MQ-4C Triton unmanned aircraft systems (UAS). Acquisition of the Tritons will begin once the development of the UAS is completed.

Australia's P-8As will be operated by Nos 10 and 11 Squadrons from Edinburgh. Training for the Australian flight and maintenance crews is conducted with Patrol Squadron (VP) 30 at the Integrated Test Center (ITC) at NAS Jacksonville, Florida.

Australia's Department of Defence initially purchased eight P-8As in February 2014, and four more followed in July 2016. The decision to add three extra aircraft was included in Australia's Defence 2016 White Paper. Delivery of the final batch will occur during the late 2020s. ***Tom Kaminski***

A P-8A operated by the RAAF's No 11 Squadron conducts a training flight near RAAF Base Edinburgh on March 23, while carrying a pair of AGM-84 air-to-surface missiles. **Commonwealth of Australia**

C-130Hs FOR COLOMBIA

THE COLOMBIAN AIR Force (Fuerza Aérea Colombiana, FAC) has received permission to acquire three C-130H airlifters from the US. The aircraft, which are valued at $30 million, will be acquired via the Excess Defense Articles (EDA) program. ***Tom Kaminski***

JAPAN CONSIDERS STOVL F-35B

ELECTED OFFICIALS IN Japan have proposed purchasing the short take-off and vertical landing (STOVL) F-35B and introducing a multi-purpose aircraft carrier. It would be operated solely for defensive purposes and could also serve as a hospital ship. Conversion of the Japan Maritime Self-Defense Force's two Izumo-class helicopter destroyers will be an option. The proposal is one of several intended to improve Japan's defense capabilities that will be considered this year when the government reviews the National Defense Program Guidelines. The government is concerned over North Korea's nuclear and missile development and China's military build-up and increasing maritime presence. ***Tom Kaminski***

THE ROYAL AUSTRALIAN Air Force has formally accepted three more F-35As from Lockheed Martin. The jets were delivered to the Integrated Training Center at Luke Air Force Base, Arizona in early March. Tail numbers A35-003 and A35-004 touched down on March 8 and A35-005 followed on March 18.

The Lightning IIs are the first Australian aircraft delivered with the latest Block 3F operational flight program software load.

Australia's original pair of Block 3i F-35As was recently inducted into the US Air Force's Ogden Logistics Complex at Hill AFB, Utah where they are receiving structural, hardware and software upgrades that will bring them up to the Block 3F configuration. The RAAF will receive five more F-35As by the end of the year.

Australia's cadre at Luke includes pilots and maintenance personnel from No 3 Squadron that are assigned to the 56th Fighter Wing's 61st Fighter Squadron. The RAAF squadron is expected to go through its first F-35A airworthiness board in August, and transfer of the initial two Lightning IIs to RAAF Base Williamtown for Australian-specific validation and verification activities will occur in December.

Tom Kaminski

US Air Force pilot Maj Josh Masopust returns to Luke AFB after a training mission in RAAF F-35A A35-005 (AU-5). **Commonwealth of Australia**

LAST GLOBEMASTER III SOLD TO INDIA

BOEING HAS RECEIVED a $262-million Foreign Military Sales contract from the US Air Force Life Cycle Management Center for a single C-17A for India. The aircraft will be delivered by late August 2019 once modifications that are unique to the Indian Air Force are completed. The Globemaster III, which is currently stored at a Boeing facility in San Antonio, Texas, is the last of 10 so-called 'white-tail' C-17As that Boeing built without having a customer for them.

Tom Kaminski

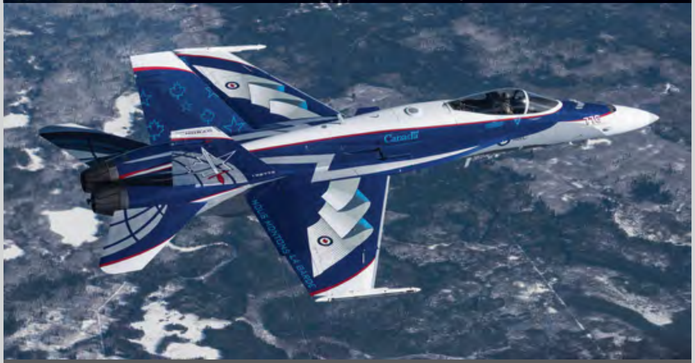
IOC FOR ITALIAN F-35As

THE F-35AS ASSIGNED to the Italian Air Force's 32° Stormo at Amendola air base, south-eastern Italy, achieved initial operational capability (IOC) on March 1. The five aircraft officially became part of the country's national air defense system as part of the Airspace Surveillance Service (Servizio Sorveglianza Spazio Aereo, SSSA) the same day. Although the aircraft are not yet standing quick reaction alert (QRA), if required they can carry a standard conventional load (SCL) that includes the AIM-120C-5 air-to-air missiles allowing them to perform the mission.

Tom Kaminski

Aeronautica Militare

CF-188 serial 188776 will serve as the demo aircraft for the RCAF during the 2018 season. The Hornet received special markings that celebrate the 60th anniversary of North American Aerospace Defense Command. It was unveiled at 4 Wing/CFB Cold Lake, Alberta, on April 3. **RCAF/MSgt John Gordinier**



RCAF DEMO HORNET REVEALED

THE ROYAL CANADIAN Air Force unveiled its freshly painted 2018 CF-18 demonstration team jet at 4 Wing CFB Cold Lake, Alberta, on April 3. The Hornet carries a paint scheme that honors the year's 60th anniversary of North American Aerospace Defense Command (NORAD), which was jointly established in 1958 by Canada and the United States. The organization continues to maintain a '24/7' watch to protect both countries.

The demonstration team subsequently relocated to 19 Wing CFB Comox, British Columbia, where it will refine its routine before the first airshow performance at Joint Base McGuire-Dix-Lakehurst, New Jersey, on May 4, 2018.

For the 2018 season the demonstration will be flown by Capt Stefan 'Porcelain' Porteous, who was most recently assigned to 433 Tactical Fighter Squadron at 3 Wing CFB Bagotville, Québec.

Tom Kaminski

IAF

TEJAS GOES ON EXERCISE

THE INDIAN AIR Force (IAF)'s Tejas Light Combat Aircraft (LCA) took part in Exercise 'Gaganshakti 2018' in April. This year's event, which involved more than 1,100 aircraft being deployed to forward bases, was the first in which the Tejas has participated.

According to the IAF, 'the operational efficiency and mission-worthiness of these platforms would be put to the test in a real-time intense exercise environment'. The exercise included testing of the LCA's air defense and strike capabilities.

CANADIAN HELICOPTERS TO MALI

THE CANADIAN GOVERNMENT is sending an Air Task Force (ATF) to provide urgently needed transport and logistics capacity for United Nations forces in Mali. It will include four CH-146 and two CH-147F utility and heavy-lift helicopters. Announced on March 19, the task force will support the United Nations Multi-dimensional Integrated Stabilization Mission in Mali (MINUSMA) for 12 months.

Tom Kaminski

DUELS AT ALBACETE

FIRST TLP EXERCISE OF 2018

A French Air Force Mirage 2000D blasts off from Albacete. These jets took part in TLP 2018-1 alongside French Navy Rafale Ms. **Stephan de Bruijn**

Supporting assets included this Italian Air Force Gulfstream E-550A conformal airborne early warning (CAEW) aircraft and the Spanish Air Force's rarely seen CASA EC-212 electronic intelligence (ELINT) platform. **Stephan de Bruijn**

MISSION: DEFEND BALTIONA. Enemy aircraft from the state of Bussia could interfere with our operations'. With full concentration, today's mission commander (MC) is brainstorming with around 50 NATO pilots, plus meteorological and intelligence personnel. They are planning a realistic and complex combined air operation (COMAO) that will begin in three hours at Albacete air base, Spain, home of the Tactical Leadership Programme (TLP). Although it is mid-February, the weather in southern Spain is excellent.

The first TLP exercise of 2018 drew participants from France, Germany, Greece, Italy, the Netherlands and Spain. The Albacete flight line was filled with Rafale Ms, Mirage 2000Ds, F-16AMs, F-16C/Ds, EF2000s and EF-18s.

A full battle plan was formulated during each COMAO brainstorming session. In the course of the exercise, the young TLP pilots (each with an average of 500 to 1,000 fast jet flying hours to their name) learned how to lead a formation of different types and capabilities to a target. The MC, leading the session, served as the data collector for all suggestions that arose as a result. These ideas fed into an analytical strategy with the aim of defending the fictional land of Baltonia.

Experienced instructor pilots — most of them veterans of campaigns in the Balkans, Persian Gulf and Afghanistan — sometimes interjected in the discussions to ensure the young pilots were on the right track. Red Air pilots were present at the beginning, but they left in time to make their own plans for the Bussian side.

Dutch Maj Toon is a member of the international TLP staff and an instructor: 'All participating nations work closely together during this first course of the year. For the pilots, this is a first chance to operate as a leader with an international coalition. After finishing the course, the next step could be leading a COMAO against ISIS over Iraq and Syria.'

Toon continued, 'During the intensive four-week course, instructors present all kinds of surprising scenarios. The pilots must act quickly and creatively. One day the COMAO might attack a naval vessel, and the next the package must assist in retrieving a pilot behind enemy lines.' For the latter scenario, US V-22 Ospreys and Italian combat search and rescue helicopters were involved.

Toon served as an MC several times over Iraq, where he led a COMAO in combat. 'Being an MC is a tough job', he reflected. 'But TLP is a good school'. To the four Dutch pilots at TLP 2018-1, Toon had the following advice: 'You are allowed to make mistakes during TLP; try to learn from them. The tools you get from this program are a springboard to the rest of your career.'

Although TLP 2018-2 has been cancelled, TLP 2018-3 will return to Albacete, while the next exercise is planned to take place at the Italian air base at Amendola. This will be the first TLP with participation by the F-35A.

Toon added, 'As TLP staff we're looking forward to the F-35 within our program. But, don't forget, the Lightning II is just a fighter, but one with special capabilities. If we want to keep TLP relevant, we must innovate. During TLP 2018-4 we will get that chance.' ***Stephan de Bruijn***

Royal Netherlands Air Force F-16AMs were back at TLP for the first time since September 2016. Due to real-world taskings in the Baltic and the Middle East, the RNLAF command had postponed participation up to now. **Stephan de Bruijn**

CHILEAN BLACK HAWK DELIVERY NEARS

SIKORSKY AIRCRAFT'S PZL Mielec subsidiary will begin delivering six S-70i helicopters to the Chilean Air Force this summer. The initial batch of three Black Hawks, ordered in December 2017, will be turned over in August and the remainder will follow in October. The new S-70i models will operate alongside a single UH-60L already in service with the air force's Grupo 9 at Colina, north of Santiago.
Tom Kaminski

POTENTIAL F-16 SALE TO SLOVAKIA APPROVED

THE US STATE Department has approved a possible Foreign Military Sale to Slovakia of F-16 aircraft and associated equipment, weapons and support. The project, which has an estimated value of $2.91 billion, includes 14 Block 70/72 F-16V series aircraft that will be equipped with General Electric F110 or Pratt & Whitney F100 engines and AN/APG-83 active electronically scanned array (AESA) radars. Weapons included in the package comprise 30 AIM-120C-7 and 100 AIM-9X air-to-air missiles, 500lb (227kg) bombs and associated precision guidance systems, and six AN/AAQ-33 Sniper pods.

Slovakia is considering both the F-16V and the Saab JAS 39 Gripen to replace its current fleet of MiG-29s, which are not interoperable with US forces or regional allies. A final selection is expected by the end of June. ***Tom Kaminski***

SPAIN REQUESTS CHINOOKS

THE POSSIBLE FOREIGN Military Sale of CH-47F cargo helicopters to Spain has been approved by the US State Department. The government of Spain requested permission to purchase 17 Chinooks in a deal that could be worth as much as $1.3 billion. It includes customer-unique modifications and aircraft survivability equipment (ASE).
Tom Kaminski

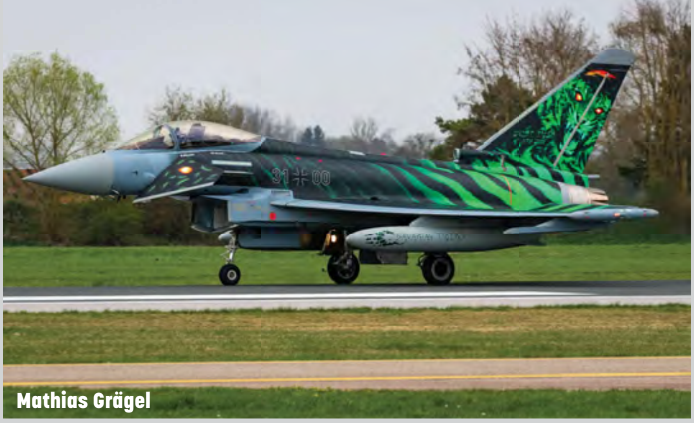
LUFTWAFFE REVEALS 'GHOST TIGER' EF2000

THE LUFTWAFFE HAS prepared a new special colour scheme for the forthcoming NATO Tiger Meet, to be held in Poland.

The markings have been applied to Eurofighter EF2000 31+00 (GS077), known as 'Ghost Tiger', which made its maiden flight wearing the new design on April 16.

The jet is operated by Taktisches Luftwaffengeschwader 74 (TaktLwG 74) 'Bavarian Tigers', based at Neuburg in Bavaria.

Poland's 31. Baza Lotnictwa Taktycznego (31st Tactical Aviation Base) at Poznań-Krzesiny hosts the 2018 Tiger Meet from May 14-25 — the first time it has been held in eastern Europe.


Mathias Grägel

GERMAN TRITON PURCHASE APPROVED

THE US STATE Department has given its approval for the possible Foreign Military Sale of MQ-4C Triton unmanned aircraft systems (UAS) to Germany. Germany had requested permission to purchase four Triton air vehicles and one mission control station (MCS) comprising single MD-3A main operating base (MOB) and MD-3B forward operating base (FOB) systems. The package, which has an estimated value of $2.5 billion, includes associated systems, spares, support equipment, training and support. The Tritons will feature German-unique modifications that will be made to the baseline US Navy MQ-4C configuration. Airbus Defence and Space, located in Germany, will be responsible for the unique systems. Germany had previously cancelled plans to purchase the RQ-4E EuroHawk variant of the Global Hawk.
Tom Kaminski

AFGHAN AIR FORCE MAKING PROGRESS

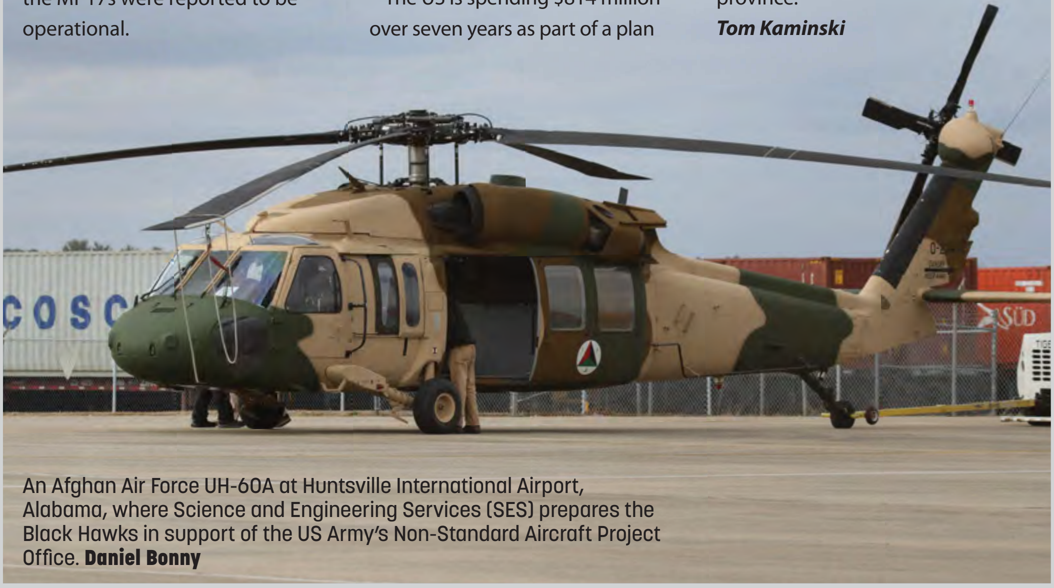
SINCE RECEIVING ITS first UH-60As from the US last November, the Afghan Air Force (AAF) has taken delivery of 11 of the helicopters, which are stationed at Kandahar Airfield. Under current plans the air force will receive 20 additional Black Hawks by the end of 2018. The US expects to deliver 159 of the helicopters by 2023.

The Black Hawks are replacing the AAF's current fleet of 46 Russian-built Mi-17s. Only 25 of the Mi-17s were reported to be operational.

The first group of Afghan UH-60A pilots is in the final phase of instruction with US advisers at Kandahar. As part of their 16-week transition course, the pilots spend six weeks undergoing aircraft qualification training and another 10 on mission qualification training. More than 30 AAF personnel are entering the second phase of training after undergoing instruction in the US, the Czech Republic or the United Arab Emirates.

The US is spending $814 million over seven years as part of a plan to update the AAF's capacity and capabilities. In addition to the Black Hawks the air force is receiving Cessna AC-208 light attack and surveillance aircraft, A-29B light attack aircraft and additional MD530 attack helicopters.

An A-29B operated by the AAF dropped a laser-guided bomb in combat for the first time on March 22. The 250lb (113kg) GBU-58 was delivered against a Taliban compound in Afghanistan's Farah province.
Tom Kaminski


An Afghan Air Force UH-60A at Huntsville International Airport, Alabama, where Science and Engineering Services (SES) prepares the Black Hawks in support of the US Army's Non-Standard Aircraft Project Office. **Daniel Bonny**

LOSSES

Compiled by **Tom Kaminski**

- A **US Air Force F-22A** operated by the 3rd Wing was damaged in a take-off incident at NAS Fallon, Nevada, on April 13. The Raptor was supporting the US Navy's TOPGUN Strike Fighter Tactics Instructor (SFTI) program at the time. No injuries were reported.
- A **Russian Navy Ka-29** crashed in the Baltic Sea during a night training exercise with a naval vessel on April 12. Both crew were killed when the helicopter went down west of Kaliningrad.
- A **Yak-130** trainer operated by the **Russian Air Force**'s Krasnodar Higher Aviation School crashed on a training flight near Borisoglebsk in the Voronezh Region on April 12. The student and instructor pilots both ejected safely.
- The pilot of a **Hellenic Air Force Mirage 2000-5** was killed when the fighter crashed in the Aegean Sea off the coast of Skyros on April 12. The Mirage, which had been assigned to 331 Mira, apparently went down around nine miles (14.5km) north-east of the island. It was reportedly one of two jets scrambled to intercept a pair of Turkish F-16Cs over the Aegean, near the Greek island of Lesbos, and was returning to base when the mishap occurred.
- An **Il-76TD** operated by the **Algerian Air Force** crashed shortly after take-off from Boufarik airfield in northern Algeria on April 11, killing 10 crew and 247 military personnel, family members and civilians. The aircraft, which carried the registration 7T-WIP (c/n 1043419636), came down in a field near Bilda around 18.6 miles (30km) south-west of Algiers.
- **Serbian Air Force G-4 Super Galeb** serial 23742 crashed near Kovačica, around 25 miles (40km) north-east of Belgrade, on April 11. Despite ejecting from the trainer, the pilot, who had been assigned to the air force's Technical Test Center, was killed. The co-pilot survived but was injured.
- **Luftwaffe CH-53G** serial 84+26 was damaged when its main rotor struck the control tower at Hassfurt-Schweinfurt Airfield in Bavaria, while it was taxiing on April 9. Debris from the building and the helicopter struck and killed an airport official on the ground.
- Two **US Army** aviators were killed when **AH-64E** serial 17-03125 crashed during a training mission at Fort Campbell, Kentucky, on April 6. The mishap occurred during a night training mission and involved an Apache operated by the 101st Airborne Division.
- An **Italian Navy AB212ASW** crashed in the Mediterranean Sea while conducting a night training mission as part of Operation 'Mare Sicuro' (Secure Sea) on April 6. One crew member was killed in the mishap, which occurred while the helicopter was preparing to land aboard the Italian Navy patrol vessel *Comandante Borsini* (P 491).
- Both crew aboard a **Republic of Korea Air Force F-15K** were killed when the fighter crashed into a mountain near Chilgok, North Gyeongsang Province, on April 5. The Slam Eagle was returning to Daegu Air Base after conducting a mission when it struck Mount Yoohak.
- An **F-16C** assigned to the **US Air Force** Air Demonstration Squadron, the Thunderbirds, crashed during a routine aerial demonstration training sortie on the Nevada Test and Training Range near Nellis AFB on April 4. The pilot of Thunderbird 4, Maj Stephen Del Bagno, was killed.
- A **US Marine Corps CH-53E** assigned to Marine Heavy Helicopter Squadron (HMH) 465 crashed north of Plaster City, California, on April 3. The accident occurred a few miles from the US-Mexico border around 15 miles (24km) west of NAF El Centro. Four crew aboard the Super Stallion were killed. The helicopter had departed from the Strategic Expeditionary Landing Field at Marine Corps Air Ground Combat Center Twentynine Palms, California.
- A **US Marine Corps CH-53E** attached to Marine Medium Tilt-rotor Squadron (VMM) 162 'suffered structural damage' in a hard landing at a landing zone at the French Army's Arta Beach Training Center (CECAP) in Djibouti on April 3.
- An **US Marine Corps AV-8B,** BuNo 165384, attached to Marine Medium Tilt-rotor Squadron (VMM) 162 crashed during take-off from Djibouti-Ambouli International Airport on April 3. The pilot ejected safely and suffered only minor injuries. The Harrier II and the Super Stallion assigned to the same unit had both been deployed aboard the amphibious assault ship USS *Iwo Jima* (LHD 7) as part of the 26th Marine Expeditionary Unit (MEU) and were supporting the 'Alligator Dagger' training exercise in international waters off the coast of Djibouti. The reminder of the exercise was cancelled following the two mishaps.
- **Chengdu F-7M** serial 1648 operated by the **Myanmar Air Force** crashed into a paddy between Chingon and Zeegon villages in Toungoo Township, Bago region on April 3. The pilot was killed when the fighter came down around 3 miles (5km) west of Toungoo air base.
- A **Mi-17V-5** operated by the **Indian Air Force** crashed while landing on a helipad near the Kedarnath temple in the Rudraprayag district of Uttarakhandon, injuring six personnel including two pilots on April 3. The mishap reportedly occurred while the helicopter was carrying an external load of construction materials.
- The pilot of an **unidentified Royal Air Force of Oman aircraft** was killed in a crash that occurred during a training mission on April 1.
- A **T-35** trainer operated by the **Chilean Air Force** crashed within the confines of the El Bosque air base, near Santiago, on March 29. Both the student and instructor pilot aboard the Pillán were killed.
- Both pilots aboard **Grob G120A-K** serial KAF-720 (c/n 85063) operated by the **Kenya Air Force** escaped serious injury when the aircraft crashed near Taita Taveta on March 28.
- The pilot of a **Turkish Air Force F-16C** was killed when the fighter crashed near Ovaören in the Gülşehir district of the central Nevsehir province around 161 miles (260km) south-east of Ankara on March 22.
- **Hawk T1A** XX204 operated by the **Royal Air Force** Red Arrows crashed at RAF Valley, Anglesey, north Wales on March 20. Although the pilot ejected safely, the engineer in the rear cockpit was killed. The trainer was en route from RAF Scampton to Valley when the mishap occurred.
- A **Hawk Mk132** trainer operated by the **Indian Air Force** crashed into a river bed during a training flight on March 20. The pilot ejected safely before the trainer came down in the village of Mahuldangri in the East Singhbhum district of Jharkhand. The Hawk had departed from Kalaikunda Air Force Station in Kharagpur.
- **Diamond DA40** serial NAF-214 operated by the **Nigerian Air Force**'s 401 Flying Training School crashed in Kaduna state on March 19. The student pilot was not injured when the trainer went down in Kauran Dawa, Saminaka.

SAUDI KING AIR CONTRACT

THE SIERRA NEVADA Corporation has been awarded a $14-million Foreign Military Sales contract modification from the US Air Force Life Cycle Management Center that provides for the modification of two King Air 350 Extended Range aircraft with intelligence, surveillance, reconnaissance (ISR) and synthetic aperture radar (SAR) capability for Saudi Arabia. The effort includes the delivery of a transportable ground station, fixed ground station and mission system trainer. ***Tom Kaminski***

KUWAIT ORDERS SUPER HORNETS

BOEING HAS RECEIVED a $1.16-billion contract from US Naval Air Systems Command to deliver 28 Super Hornets to the Kuwait Air Force. The package includes 22 single-seat F/A-18E and six two-seat F/A-18F variants as well as options for 12 additional fighters. The Super Hornets are intended as replacements for Kuwait's current fleet of 27 F/A-18Cs. The US State Department had previously approved the sale of up to 40 Super Hornets to Kuwait in late 2016. ***Tom Kaminski***

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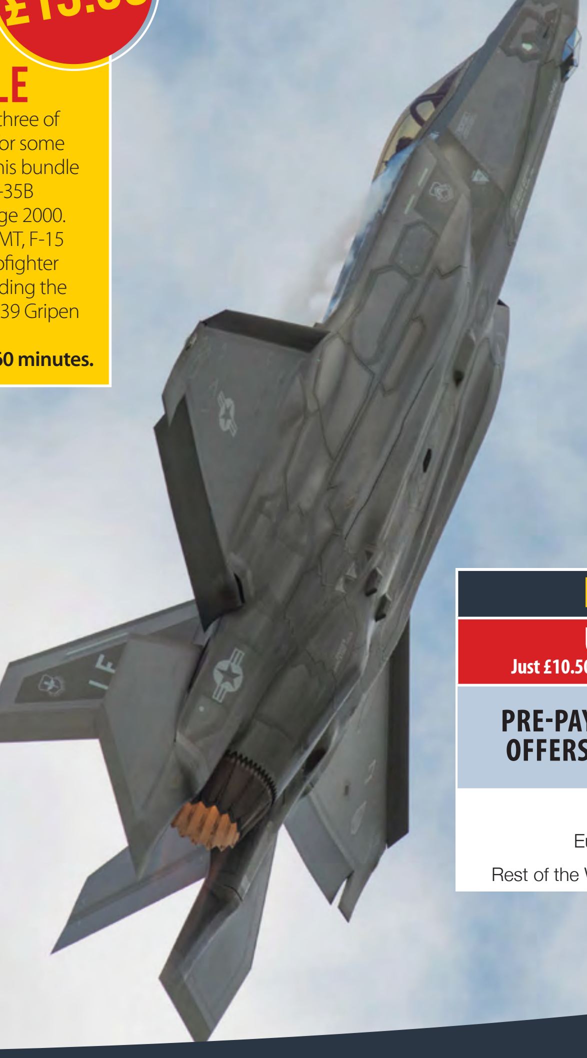

Image: USAF - Airman 1st Class Alexander Cook

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EYE ON THE EAST

BY **ANDREAS RUPPRECHT**

AIR WARFARE BRIEFINGS FROM THE ASIA-PACIFIC

CHINESE Su-35 DETAILS REVEALED

IN EARLY FEBRUARY 2018, a surprising official announcement marked not only a dramatic shift in the balance of power in the South China Sea but also a rare official confirmation of activities by the People's Liberation Army Air Force (PLAAF). The Chinese air arm went on record to say it had deployed several of its new Su-35 'Flankers' for a joint combat patrol mission in this tense region.

Combat Aircraft has already reported on China's new Su-35s that originated from a long-negotiated contract that was finally signed on November 19, 2015, with a second following in January 2017.

Talk of a Su-35 sale to China was met with near disbelief in many reports, and to this day little is actually known other than that the first batch of aircraft was delivered a few days after Christmas 2016 and that two more sets of deliveries followed in July and December 2017, accounting for around 14 aircraft, with a further 10 expected to arrive this year.

Until the recent exercise, it appeared that the PLAAF was keen to keep a lid on details of its newest fighters. There was an overall air of mystery around the entire deal. However, there was Chinese confirmation that the deal was worth around $2 billion — equating to about $83 million per aircraft — as the PLAAF became the first export customer for the type.

The Su-35 contracts represent the most significant military aircraft deal between Russia and China in recent years, but there is no official word as to why the Su-35s have been acquired in addition to local 'Flanker' developments such as the active electronically scanned array (AESA) radar-equipped J-11D, or even the indigenous J-20. Moreover, the PLAAF engaged in its usual game of cat and mouse with observers.

On delivery, the first four Su-35s landed as expected at the PLAAF's Flight Test and Training Center (FTTC) at Cangzhou-Cangxian, only to continue further south after a brief fuel-stop. A

One of the first PLAAF Su-35 images that broke cover related to February's deployment for operations in the South China Sea region. **All images via Chinese Internet**

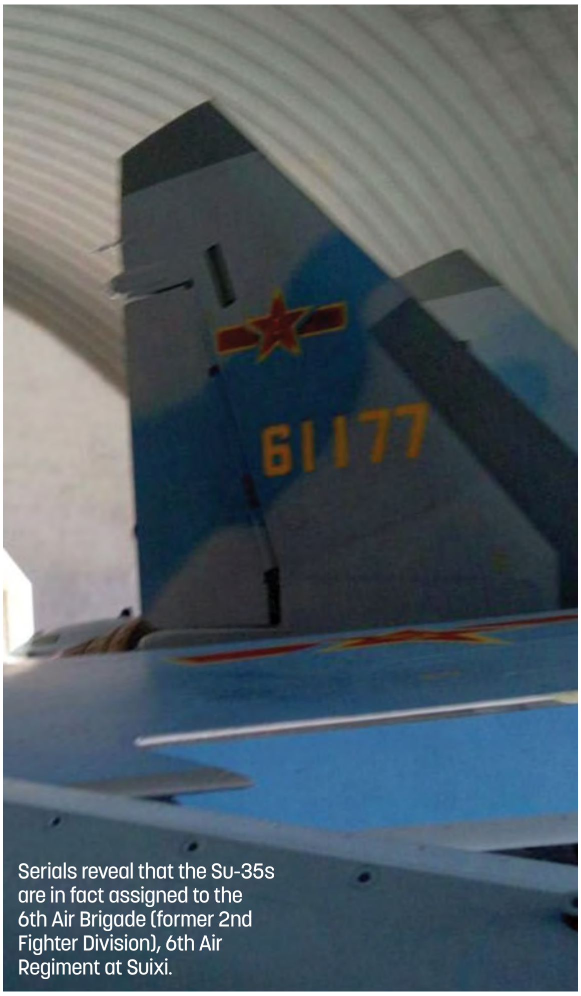
Right: Another South China Sea mission image. Speculation has raged that China acquired the Su-35s in order to better understand thrust-vectoring controls.

few small, grainy images subsequently broke cover, but neither the true home base nor details of operations were published.

Most PLAAF watchers expected the Su-35s to be assigned to a test unit so that the thrust-vectoring controls (TVC) could be evaluated, as well as to explore its operational effectiveness against existing PLAAF assets during events such as 2017's 'Red Sword' exercise. In fact, many had swiftly concluded that China was only interested in the Su-35's izdeliye 117S/AL-41F1S engines, while others suggested that, given China's local 'Flanker' programs, the deal was politically motivated.

In *Combat Aircraft's* opinion, one sole reason seems unlikely — and frankly too simplistic. It was unlikely to be procured based purely on the TVC engine and thus related to China's indigenous projects such as the uprated WS-10 and WS-15 engine planned for the J-20.

The deal ultimately delivered benefits for both parties. Russia finally secured a first export customer for the Su-35, and the PLAAF gets hold of what is arguably its most capable fighter to be assigned to an operational unit — off-the-shelf. As a by-product, China gets an insight into the latest Russian avionics and propulsion systems, coupled with a chance to explore TVC, and to develop tactics, while deepening Sino-Russian co-operation.



Serials reveal that the Su-35s are in fact assigned to the 6th Air Brigade (former 2nd Fighter Division), 6th Air Regiment at Suixi.

Hard facts

By confirming their serials, *Combat Aircraft* can confirm that the PLAAF Su-35 are in fact assigned to the 6th Air Brigade (former 2nd Fighter Division), 6th Air Regiment at Suixi, which is close to the important Southern Fleet Headquarters at Zhanjiang. The Suixi unit is assigned to the important Southern Theater Command that has in recent years also gained the latest J-10B at Guilin. The Suixi Su-35s are slated as replacements for the oldest Su-27SK/UBKs and J-11s in PLAAF service. This underscores Chinese priorities in this disputed area, where the new type will act as a long-range fighter escort for H-6K bombers and special mission aircraft.

Interestingly, the new aircraft reportedly all feature cockpit instruments in Russian. Therefore the Chinese pilots had to speak or learn to speak Russian to be assigned as Su-35 pilots. The aircraft feature the same

This image: The South China Sea deployment saw the jets firing 80mmm rockets from under each wing.

Below: A flight of Su-35s all equipped with the new L265M10-2 Khibiny-M export-standard electronic countermeasures pods on the wingtips.

Irbis-E passive electronically scanned array radar and digital fly-by-wire control system with TVC engines. A minor external difference can be found in the deletion of the middle navigation antenna from the trailing edge of the right vertical stabilizer. The Su-35s have also been seen carrying the new L265M10-2 Khibiny-M export-standard electronic countermeasures pods on the wingtips instead of air-to-air missiles. To date they have only been seen without AAMs but the deal is thought to have included medium-range R-77-1 missiles.

The PLAAF officially acknowledged its Su-35s on February 7, announcing that 'the deployment [to the South China Sea] is part of the Air Force's efforts to carry out military training under combat conditions,' and adding that the 'Su-35 fighter jets participating in such training are expected to enhance the Air Force's combat capability under long-distance or high-sea conditions.'

It was an interesting move by the Chinese authorities that exercise very tight control over information flow — especially when it comes to the most modern assets. This is usually observed through a subtle mixture of controlled leakage and absolute silence. Indeed, it wasn't to end there. Two days later on February 9, a spokesman officially confirmed the entry into service of the J-20A in a combat unit assigned to the Eastern Theater Command. The fighter community is never standing still when it comes to the PLAAF.

> “Until the recent exercise, it appeared that the PLAAF was keen to keep a lid on details of its newest fighters. There was an overall air of mystery around the entire deal

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MAY ISSUE FEATURES:

MIG-31: ONE OF A KIND

Piotr Butowski examines the current status of the MiG-31 Foxhound, a Cold War-designed interceptor that recently returned to the news as the launch platform for one of Russia's new 'super weapons' – the Kinzhal hypersonic missile.

VIEW TO A KILL – PART ONE

In the first of a two-part feature, Douglas Barrie and Piotr Butowski review the short-range air-to-air missiles currently in service around the world.

DRAGON LADY AT WAR

The US Air Force's U-2 'Dragon Lady' spy planes have played a key intelligence, surveillance and reconnaissance role over Syria and Iraq since the start of Operation Inherent Resolve, as Babak Taghvaee recounts.

TRAINING A TYPHOON PILOT: PART TWO

Concluding a two-part feature, Jamie Hunter returns to No 29 Squadron at RAF Coningsby, Lincolnshire, to learn how Royal Air Force Typhoon pilot training has evolved in recent years.

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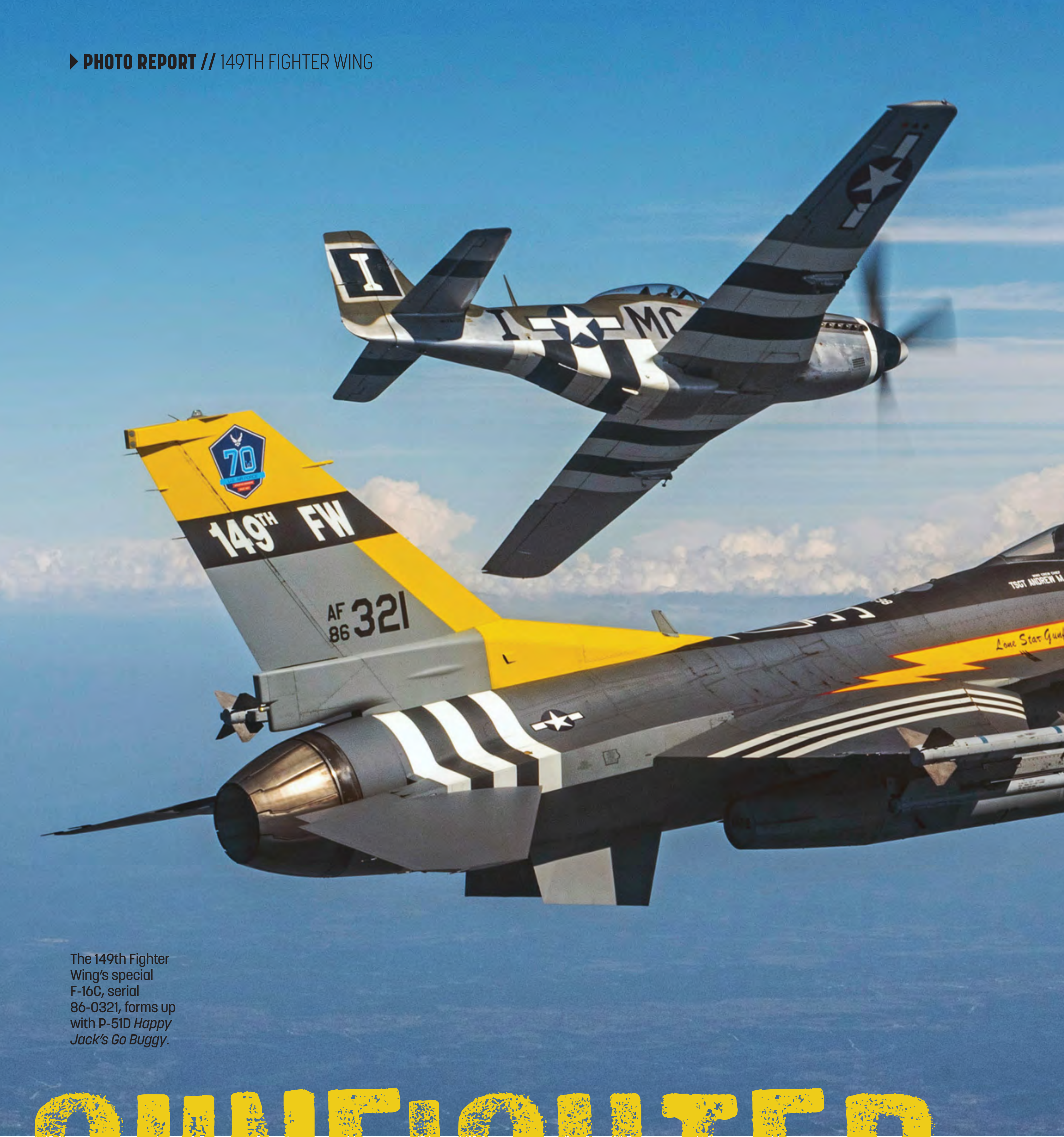
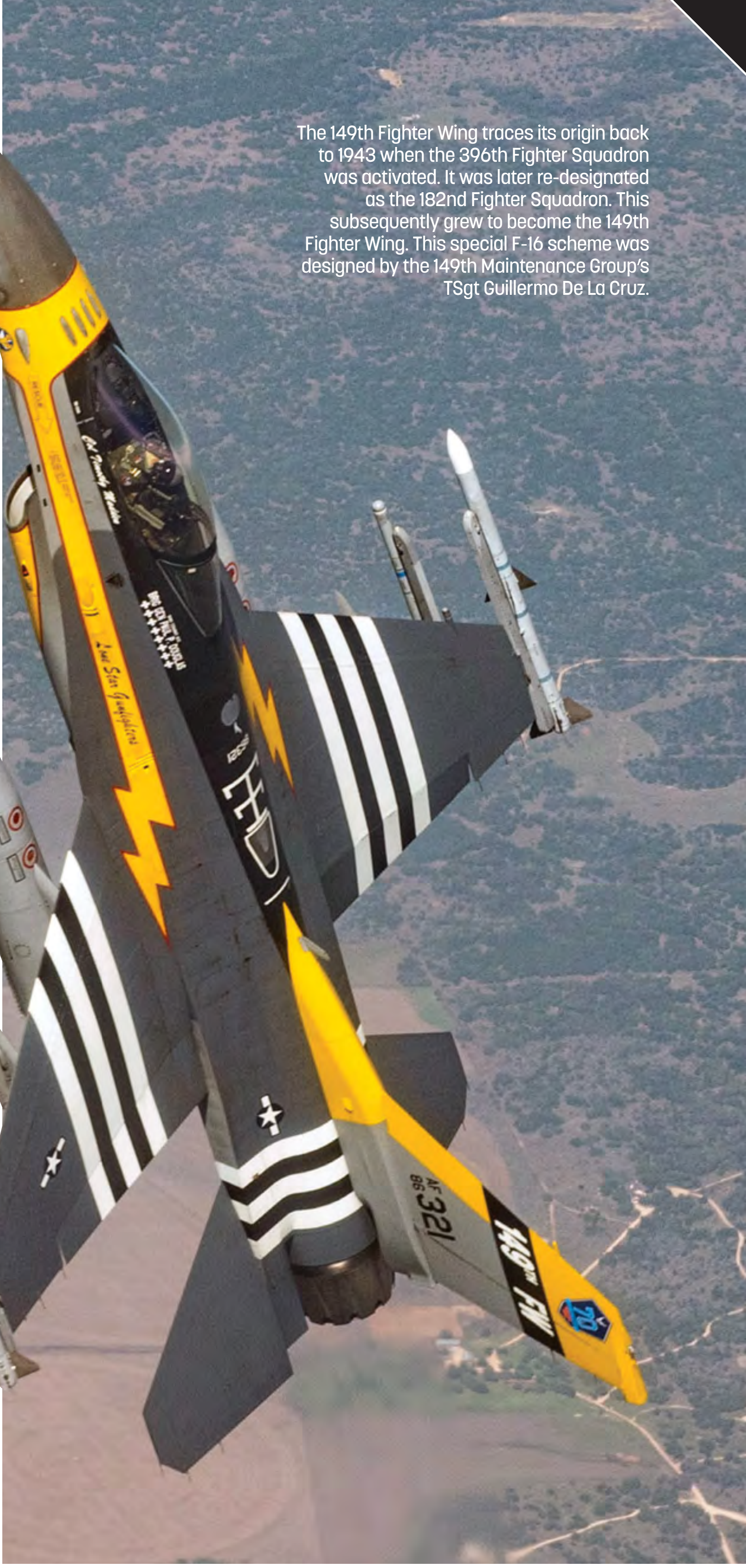


The 149th Fighter Wing's special F-16C, serial 86-0321, forms up with P-51D *Happy Jack's Go Buggy*.

GUNFIGHTER HERITAGE



The 149th Fighter Wing traces its origin back to 1943 when the 396th Fighter Squadron was activated. It was later re-designated as the 182nd Fighter Squadron. This subsequently grew to become the 149th Fighter Wing. This special F-16 scheme was designed by the 149th Maintenance Group's TSgt Guillermo De La Cruz.

The 149th Fighter Wing 'Lone Star Gunfighters' marked the 70th anniversary of the US Air Force in 2017 by painting one of its F-16Cs in special markings that hark back to the unit's origins.

PHOTOS **Liz Lutz**

THE AIR NATIONAL Guard's 149th Fighter Wing 'Lone Star Gunfighters', based at Joint Base San Antonio-Lackland, Texas, has made a special formation flight to showcase its heritage jet — F-16C Block 30 serial 86-0321. The 149th FW applied the striking markings to commemorate the USAF's 70th anniversary last year, taking the opportunity to commemorate the wing's lineage. The chosen livery dates back to a 396th Fighter Squadron 'Thunder Bums' P-47 Thunderbolt paint scheme from 1944.

The recent formation flight saw the specially painted F-16 flying alongside P-51D Mustang 44-74452/N74190 *Happy Jack's Go Buggy*, which is locally owned and operated.

SHARPENING THE B-ONE

Despite a plan to retire the B-1B Lancer earlier than anticipated, the US Air Force is continuing with several initiatives to keep the bomber relevant. Following on from our coverage of Lancer deep maintenance last month, *Combat Aircraft* looks at the testers who are keeping the B-1 at the top of its game.

REPORT AND PHOTOS **Jake Melampy**

THE ROCKWELL B-1B Lancer has become a mainstay of combat operations for the past two decades, being worked hard in the skies over Afghanistan, Iraq, Syria, and Libya as well as supporting the Continuous Bomber Presence in the Pacific. It has developed into a very useful all-round conventional precision striker.

Dyess AFB is one of two B-1 main operating bases, with no fewer than 40 of the sleek machines to be found at the western Texas station. Adjacent to the two large complexes of the 9th and 28th Bomb Squadrons here, and slightly further down the massive Dyess flight line, is a much smaller building. The work undertaken inside has played an instrumental part in making the B-1 the combat-proven workhorse of the 21st century that it has become.

The 77th Weapons Squadron (WPS, pronounced 'whips') and 337th Test and Evaluation Squadron (TES) share this facility. Each unit uses half of the building, with a large ops desk in the center, dividing the structure into two equal sides. At first glance it would seem as though there is little 'crossbreeding' between the two. However, that appearance is superficial. It is the close working relationship between them that makes the arrangement so effective and productive.

Lt Col Jaime Hernandez is the 337th Test and Evaluation Squadron commander. 'Our guys are experienced instructor pilots or WSOs [weapons systems operators]. They've come from the operational squadrons and it's the guys in those squadrons that are going to use what we're testing. We figure out how to break this stuff, which is a rough term, but we put [the new equipment] into an environment in which it is going to be used. We want to fly it, use it, and abuse it, just like an aircrew in the combat bomb squadrons is going to do — not just in a training environment, but in a real-world operational combat environment. Everything we do here is operationally [representative] of what the units that will be using it do, and we can see if it meets the operational requirements.

'The other part of what we do is develop TTP — tactics, techniques, and procedures. We develop the academics so that the operational crews know how to use this new widget that we're

testing. Then we figure out how to employ the new software or gadget in terms of putting bombs on target, or survivability against threats, etc. We develop those tactics that are sent out to the operational squadrons.'

Real-world test pilots

As opposed to test pilots at California's Edwards AFB, for example, operational test crews with the 337th TES receive very little specialist training on how to assess new equipment. Hernandez says this is intentional and helps them do their job well. 'There isn't a detailed process for guys coming into the squadron, because we want to replicate an operational environment. We don't try to take the guy from the operational squadron and turn him into a tester. We've lost that real-world representative if we do that.'

Personnel from the 337th attend countless seminars and meetings as new software or capabilities are planned, so they can be the voices of those on the front line. 'One of the things we do, that I feel is one of the most important pieces of our mission next to flying, is the meetings with the contractors and systems program officers when they are developing what the new software or capability is going to look like. We try to get to these meetings early in the process, to have an operational influence before the planning and design process develops too far, to make sure that what's being developed will actually be useful.'

New ideas for software or hardware upgrades often come from those serving in front-line units and influence the list of things crews would like to see come to reality. The suggestions are presented to test engineers, who decide whether they are feasible.

Following a rough design, the initiatives are presented to the 337th TES, as well as the developmental test program at Edwards AFB, to receive feedback. Often this process is repeated numerous times before a design is settled on and returned to the unit for testing. Other times, the ideas are mandated by Air Combat Command and the unit is told to evaluate them before installation into the B-1.

A wide range of airspace is required for the test missions, and it 'depends on the item we're testing,' says Maj 'Mog' Tull, 337th TES assistant director of operations. 'When we're testing our defensive avionics system, for example, we'll go to a range that has the resources we need with the level of fidelity that the engineers require. Nellis [in southern Nevada] is a fantastic range we try to use a lot. From our perspective, though, it can be tough... it's hard for us to get to because a lot of guys want to use it. We get a fair amount of priority, so we can usually make it happen.

'We go out to Edwards a lot, especially when we're doing low-altitude or terrain-following missions. They have great routes that have been planned in exquisite detail so we can fly choreographed routes to get great data. We also try to jump into as many exercises as we can, whether air force or navy. That helps us develop TTPs, since we get the training of how to work with other platforms or even other branches of the military, and how to integrate with them.'

The 337th Test and Evaluation Squadron sits alongside the 77th Weapons Squadron at Dyess, creating a center of excellence for the B-1.

Above: In the right-hand pilot seat is a USAF Test Pilot School graduate. This is unusual for the 337th TES, which demands crews with an operationally relevant squadron background.

Inset: Down the back – a weapons systems officer evaluates some of the latest kit, in this case enhancements to the Block 16 cockpit displays.

Self-supporting

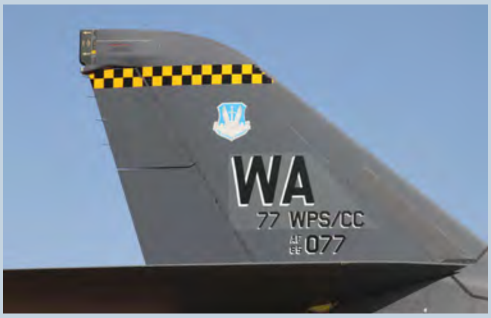
Despite being a relatively small operation within the greater scope of the host 7th Bomb Wing at Dyess, the 337th TES is a mostly self-supporting and self-contained unit. Hernandez explains, 'We have two aircraft that are actually 7th Bomb Wing machines that are loaned to us. They fall under the 337th, and we'll modify those aircraft, change the software, whatever the case may be. Our maintainers take care of them for the most part, but the bomb wing does the heavy maintenance. Those jets are interchangeable, though. If one is broken or otherwise unavailable, the bomb wing is still required to provide us with a pair of aircraft. That's something that we continue to work with them on, because they do have an operational requirement. However, our two aircraft are specifically funded by Congress. We have our own specialists, and our own crew chiefs. We do all that in-house at the 337th.'

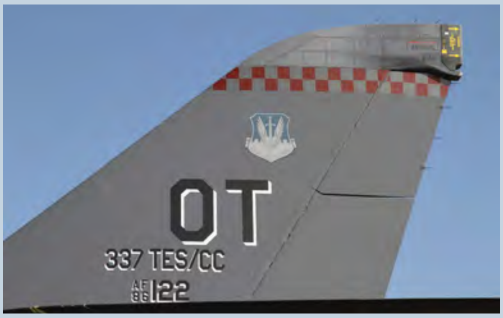
The jets are modified specifically for the test mission, with, for example, cameras mounted inside the cockpit to record instrumentation and data during test flights. All modifications are designed to be low-impact, meaning the jets can quickly be returned to 'normal' and returned to the fleet. According to Hernandez, 'The wing is very supportive of what we do. Occasionally we need to remind them of the importance of our mission, but they understand and know how much we support the host wing.'

Build, teach, and lead

On the other half of the building is the 77th Weapons Squadron, part of the prestigious USAF Weapons School. While the school is headquartered at Nellis AFB, the B-1 element is hosted at Dyess for logistics reasons.

Lt Col John 'Miles' McClung, the 77th WPS commander, says, 'Put simply, our mission is to build, teach, and lead — to provide the finest weapons officers possible. We create not only tactical leaders, but also critical problem-solvers and thinkers. Our graduates won't look past a problem, but will look at it differently because they've gone through this program and we've put them through so many iterations that they have the ability to think about things differently than they used to. In a combat situation, a 'patch-wearer' [weapons school graduate] can





Above: 'Patch-wearers' from the 77th WPS load up for a mission from Dyess.

[usually] solve a problem, and if they can't, they know who to call to find someone who can.'

Being located away from Nellis presents challenges the 77th must overcome. At the start of the six-month course, known as 'Core 1', all students converge at Nellis for a week of non-flying classroom academics. Once air ops begin, they return to their aircraft, which means B-1 students must go back to Texas. It isn't until the integration phase portion of the course that B-1s return to Nellis to join the rest of the weapons school just prior to graduation.

Another challenge is that the 77th doesn't own its own aircraft. It too borrows B-1s from the host 7th Bomb Wing. While the 77th tries to only fly four sorties a week, that can sometimes be a drain on the 7th's resources while it tries to generate enough missions for its combat-ready brethren. 'That is a huge challenge,' says McClung, 'but they understand the value of the investment that they provide by giving us jets. They know they're going to get a product in the end that makes them better. The bomb wing bends over backwards to make sure we have what we need to graduate our students.'

Yet another difficulty of being away from Nellis and the rest of the weapons school is the relative lack of integration. 'We'd love to be at Nellis — we'd create better 'patch-wearers' hands down, without a doubt,' says McClung. 'The air force, as a whole, would also create better 'patch-wearers' because they don't get to integrate with us as much as they'd like. Since B-1s are only at Dyess and Ellsworth [South Dakota], it's very hard for us to go out and integrate with other players.'

> “They look at real-world events and try to solve such problems as potential hostilities with North Korea or China

Only the best

Eight students graduate from the 77th each year. That breaks down to two pilots and two WSOs per course, and two courses a year. 'I know that isn't many', admits McClung. 'Other squadrons try to produce more, but I refuse to do that unless I can get more sorties. I do not want to water down my profile just to

Below: B-1B serial 85-0077 carries special marks for the commander of the 77th WPS.

produce more graduates. We're going to hold the standard high.

'We try to graduate the 'ace of the base,' if you will; that tactical expert, one of the better aviators in the squadron, but also the trusted advisor to the graduate's squadron leadership on all things tactics. The weapons officer is often the squadron commander's 'right-hand man' — he's making sure the squadron's being trained well and is ready when needed to deploy.'

Potential weapons school students are nominated through a formal board process. Each B-1 unit commander sends recommendations to their wing leader and these names are submitted to the school, which decides who to take. However, due to the small and close-knit nature of the B-1 community, every squadron commander is a graduate of the weapons school, and understands the nature and challenges of the course. Meanwhile, the 77th's instructors often travel to other squadrons to 'scout' for potential candidates and already have a good idea of who is right for the program.

The course syllabus is constantly under review to ensure the graduates are being taught to the highest level imaginable. Furthermore, upon completion of each six-month course, the weapons school as a whole converges to discuss and evaluate the school and its program. They look at real-world events and try to solve such problems as potential hostilities with North Korea or China. That immediately evolves the course syllabus. McClung adds, 'The Department of Defense loves to throw problems at us and make sure we are still creating the best weapons officer to solve any problem. When we discuss the big-picture scenarios with North Korea [for example], we may notice some holes in our syllabus that we'll fill in [during] the next course, so we are always changing and upgrading the syllabus.'

Mutual support

Being co-located helps both the weapons squadron and the test squadron enhance their overall effectiveness. Hernandez says, 'We often have weapons school guys fly with us, and we fly with them. We let them borrow our aircraft, so we can see how their students — [who] are future weapons school officers — react to the new capabilities that we are testing.

'The other big benefit is the support we get at the weapons school integration exercise at Nellis, held twice each year. We take our two assigned jets out to Nellis, so we get to test the software or capability in the most realistic combat environment possible. We can't build a better operationally relevant environment than what is done out at Nellis. During [the exercise], we have every platform the air force has available, and every capability, and they fight like they'd fight in the next war. So, what better environment is there to perform testing?'

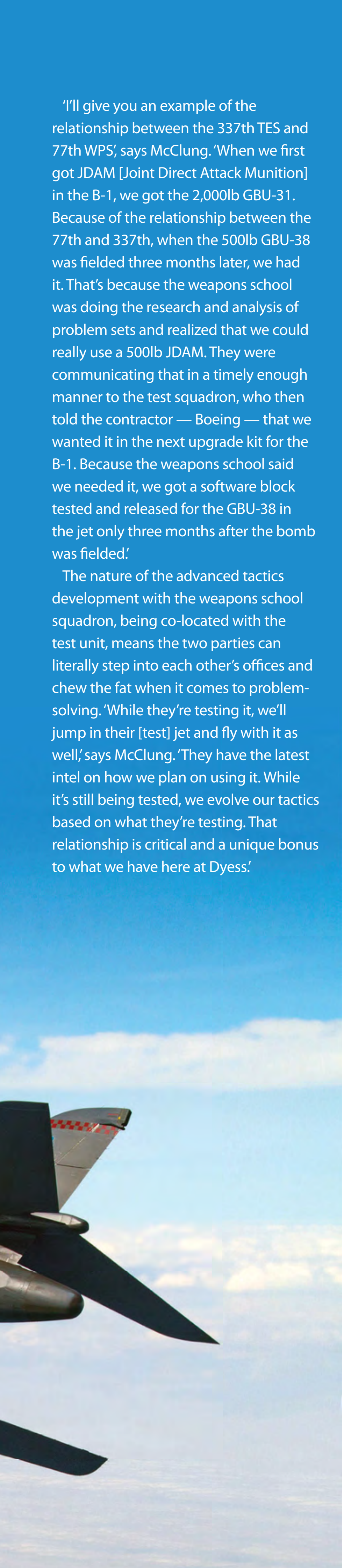
> We don't try to take the guy from the operational squadron and turn him into a tester. We've lost that real-world representative if we do that

'I'll give you an example of the relationship between the 337th TES and 77th WPS', says McClung. 'When we first got JDAM [Joint Direct Attack Munition] in the B-1, we got the 2,000lb GBU-31. Because of the relationship between the 77th and 337th, when the 500lb GBU-38 was fielded three months later, we had it. That's because the weapons school was doing the research and analysis of problem sets and realized that we could really use a 500lb JDAM. They were communicating that in a timely enough manner to the test squadron, who then told the contractor — Boeing — that we wanted it in the next upgrade kit for the B-1. Because the weapons school said we needed it, we got a software block tested and released for the GBU-38 in the jet only three months after the bomb was fielded.'

The nature of the advanced tactics development with the weapons school squadron, being co-located with the test unit, means the two parties can literally step into each other's offices and chew the fat when it comes to problem-solving. 'While they're testing it, we'll jump in their [test] jet and fly with it as well,' says McClung. 'They have the latest intel on how we plan on using it. While it's still being tested, we evolve our tactics based on what they're testing. That relationship is critical and a unique bonus to what we have here at Dyess.'

Another aspect of the co-located squadrons is aircraft availability. The 337th has two assigned aircraft, while the 77th must borrow whatever jet is available from the host 7th Bomb Wing. Often, a weapons school crew will use a test jet, getting a first-hand look at new upgrades that will soon reach the B-1 fleet. 'We like to get them spun up on the software as soon as possible', comments Tull, 'because they are some of the best resources to ensure that any new test item is working the way an operational crew would like. We like them to fly our aircraft as often as possible, so we can get their feedback.'

The B-1 community has been constantly deployed for 14 years now. The jet and tactics have evolved considerably in that time and will continue to do so for the foreseeable future, thanks to what happens in a small building on the Dyess flight line.



Above left: Maintainers load GBU-54 500lb Laser Joint Direct Attack Munitions. The OT tail code stands for operational test.

Left: The two 337th TES B-1s pitch out from the camership during a test flight.

Right top to bottom: Co-locating the operational testers with the weapons squadron was a direct influence on the B-1B getting the 500lb JDAM soon after it became available.

Operational test and WPS Lancers on the flightline at Dyess.

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BUILDING THE FUTURE OF
AIR POWE

Luke AFB in Arizona is no stranger to new fighter technology. It was here that the USAF fielded the F-15 Eagle, it has been pivotal in F-16 training, and now it is the bedrock of the future for both domestic and international F-35 training.

REPORT AND PHOTOS **Jake Melampy**

AT ONE TIME, Luke AFB, in the suburbs of Phoenix, Arizona, was home to more than 200 F-16 Fighting Falcons. It housed six USAF training squadrons, as well as one Air Force Reserve Command unit and a pair of foreign military sales units. The skies in and around the base constantly reverberated to the sound of F-16s.

But times change, and the type has been winding down in service since 2010. Replacing the 'Viper' is the USAF's newest front-line fighter, the F-35 Lightning II, which has maintained a growing presence since it first arrived at Luke some four years ago.

As things stand, the F-35 has superseded the F-16 in three resident units: the 61st, 62nd and 63rd Fighter Squadrons. Around 60 F-35s are currently stationed here. In time, 144 will be permanently assigned to Luke.

The first unit to receive the Lightning II was the 61st FS 'Top Dogs', which was reactivated in October 2013. Maj Luke 'Cloc' Outwater, an F-35 instructor pilot with the 61st, explains the present remit. 'The 61st Fighter Squadron, and Luke AFB as a whole, creates the future of air power. Quite literally — we do that every day in the 61st by taking lieutenants that have spent as little as 18 months in the air force and putting them into the cockpit of an F-35. These are called B-courses and right now are unique to Luke. Here we take them from 'zero to hero'.'

The 33rd Fighter Wing at Eglin in Florida can also conduct F-35 pilot training for B-course students but isn't doing so currently. It will generally train students with previous fighter experience who are going to fly the Lightning II operationally.

Fledgling F-35 pilots

The 61st made history on February 8, 2017, when the squadron's initial cadre of

The changing face of Luke AFB – once a hive of F-16 activity, today it is gradually being eclipsed by F-35 training.

> Pilots here at Luke are confident in the jet's future and wouldn't want to be in any other airplane if our nation called us to its defense tomorrow
>
> **Lt Col Curtis Dougherty**

B-course students took to the air in the F-35 for the first time. The class consisted of six airmen, all young pilots with no tactical fighter experience. Capt Ian 'Screech' Osterreicher, another instructor pilot with the 61st, says the lack of fighter experience can sometimes be a good thing. 'It's helpful to have a new student with no previous background, so they're a fresh plate, a brand-new sponge ready to absorb all the tactics that we're going to teach them because it's the future. Our goal is to get them through the eight-month training course and be combat-ready.'

Those six ab initio students arrived at Luke in December 2016 to begin the eight-month B-course. It starts with basic F-35 systems knowledge and academic classroom work before moving on to the new F-35 simulators on base. The B-course lasts 141 days, using a building-block approach that fuses self-study, classroom academics, a desktop pilot training aid, and the full mission simulator to prepare trainees for their first sortie in the single-seater. The students spend 300 hours in the classroom during the academic phase at the Academic Training Center, which consists of 156 events totaling 308 hours. Among the topics they are required to learn are basic aircraft systems, emergency procedures, local area procedures, mission systems, weapons and weapon systems, and tactical employment.

Each pilot must pass 10 academic tests to ensure they possess the knowledge required to fly the aircraft safely and effectively and progress to the next phase. Students are equipped with a touch-screen laptop, F-35 control stick, and throttle grip to practise interaction with the F-35 cockpit and its 8 x 20in panoramic cockpit display.

From there, says Lt Col Rhett 'Hero' Hierlmeier, 61st FS commander, the trainee completes 16 sorties in the simulator. 'The F-35 simulator provides a highly realistic and immersive experience that prepares each pilot for that first sortie. With no two-seat F-35s, the training program relies heavily on the simulator to ensure that each student is ready for the unexpected emergency. Passing the emergency procedures evaluation is the first big hurdle and paves the way to flight.'

State-of-the-art facilities

During the transition from the F-16 to the F-35, a vast new Lightning II training building was constructed on base, with state-of-the-art facilities to provide the most realistic training imaginable, as Hierlmeier describes. 'As the training progresses, up to four [F-35] simulators are linked together to enable formations to practise advanced tactics against simulated air and surface threats. Advanced debriefing capability permits instructors and students to review their performance and cement lessons learned. Over the course of the program, the

Above: The Royal Australian Air Force is spinning up its F-35A training at Luke AFB.

Left: As well as experienced crossover pilots, the first ab initio F-35 course has now been completed.

students complete 46 simulator events totaling more than 76 hours.'

During the 61st FS' initial B-course, each of the six students flew at least 48 F-35 sorties, totaling nearly 80 hours. The flights progressed from the basics of operating the type safely, including take-offs and landings, and continued across all the tactical mission sets. Students dropped live and inert weapons on the nearby Goldwater bombing range and took advantage of tanker assets to experience aerial refueling from a KC-135 Stratotanker for the first time.

Following their graduation on August 5, all six students were transferred to the 34th Fighter Squadron 'Rams' at Hill AFB in Utah, where they began flying the F-35 operationally.

The story is much the same at the 62nd FS 'Spike', which traded in its 'Vipers' and launched its initial Lightning II B-course in May 2017. Further down the expansive Luke flight line, the 63rd FS 'Panthers' began flying F-35 training sorties in October 2017, while preparing new instructors for the upcoming student courses.

While training on the new type ramps up, the target is for each unit to produce between 30 and 50 F-35 pilots each year. With aircraft deliveries on pace, and training expanding, it seems each new goal is attainable. On March 29, 2017, the 10,000th Lightning II training sortie at Luke took place, flown by a 62nd Fighter Squadron pilot. This comes less than a year after the 5,000th training flight was completed in May 2016.

'Viper' nest

Despite the new fighter being the main focus on base, the sound of F-16s can still be heard. No fewer than 78 'Vipers' call Luke home, although much of the 'Viper' training has moved out to Holloman AFB, New Mexico. Two USAF units remain at Luke: the 309th 'Wild Ducks' and 310th 'Top Hats', both of which continue to provide F-16-rated pilots to the USAF.

According to Maj David 'Hulk' Bennet, the 309th's director of operations, 'When the 309th begins reducing operations or moving is still unclear. We are planning on continuing to teach F-16 training in the 'Wild Ducks" immediate future.

'We train all levels of F-16 pilots, from those who have never touched a fighter to the more experienced pilot requalifying in the jet following a non-flying assignment. Requalification, senior officer, and instructor upgrade courses all run concurrently in each of the squadrons. The 'Ducks' average about 16-17 students on the flight line at any given time. For the B-course, each F-16 squadron has a class of at least 12 new F-16 pilots running at all times.'

Not surprisingly, the B-course is the longest in duration of the programs offered by the 309th. Bennet again: 'The duration of the formal basic course at Luke is six months of flying, with academics before and after flight training. Over 300 hours of academic instruction, 56 simulator sessions, and 50 sorties in the jet make up the basic course. All our courses and corresponding syllabi are regularly updated to ensure the latest tactics and systems are incorporated.

Right top to bottom: The Royal Norwegian Air Force is well into F-35 training and its first jets arrived in-country during November last year.

Aircraft maintainers also receive training at Luke after their initial grounding at Eglin AFB.

Below: The 63rd FS is the latest of the Luke units to convert to the F-35A.

Top: The local community in Phoenix, one of America's fastest-growing cities, is accustomed to fast jet action.

Above: A wealth of F-16 experience is retained at Luke within the active-duty component.

We can also tailor the requalification and instructor pilot upgrades based on previous experience and student desires/performance.'

Since the 309th was formed at Luke in 1992, it has graduated countless F-16 pilots. While the annual number has slowly declined over the past 10 years, the unit still completes roughly 36 formal courses each year.

All the units at Luke under the 56th Fighter Wing umbrella work incredibly closely together. Lt Col Curtis 'Cooter' Dougherty, the 61st's director of operations, says co-operation between units is, 'as close as I've seen in the air force. Between F-35 squadrons, we are in constant communication to optimize student production. Between Luke fighter platforms, we routinely co-ordinate support and integrate flying opportunities for student benefit. And across Arizona we try to leverage other joint platforms to create the most realistic training environment we can.'

This sentiment is echoed by Bennet. 'The 309th works very closely with the F-35s at Luke as well as the other units from Tucson and Yuma. We've been able to execute large force employment with local F-35As, USMC F-35Bs from Yuma, F-15Cs from Klamath Falls, and A-10s from Davis Monthan, just in the last six months. These are great training opportunities for not only our young students to integrate with 'fifth-gen' assets, but also for the F-35s to learn how we train and teach our basic course pilots.'

The cadre of instructor pilots (IPs) is the heart and soul of the training mission at Luke, whether they are in an F-16 or F-35 unit. Says Bennet, 'The IPs in the 'Ducks' have experience in every major combat operation since 'Allied Force' and are a mix of active-duty and reserve fighter pilots. IPs for Luke are selected for their past excellence in flying the F-16 and potential to be excellent instructors.' On the F-35 side, Outwater says, 'The F-35 community represents a very wide experience base. We have pilots who previously have flown the F-16, A-10, F-15E, F-15C, F-22, F/A-18, and even the Eurofighter. This is great because as a former F-15E pilot I have some pre-conceived ideas about how to employ the F-35. Bringing those ideas into a suppression of enemy air defenses mission, one that we didn't do in the F-15E, isn't as valuable as someone with F-16C experience, but that same pilot would approach me about interdiction tactics. Bottom line: we don't have to travel far to find a good answer for a problem.'

Diverse community

The value of putting quality instructor pilots into the F-35 classrooms cannot be overstated. Outwater explains, 'The air force places a high emphasis on getting younger pilots with diverse backgrounds into the F-35 community. The strategy is going to pay dividends in the long run for a couple of reasons, and one that was arguably overlooked during the rise of the F-22. We have pilots qualified in the F-35 ranking from second lieutenant all the way up to lieutenant general, unlike the F-22 which, at a similar time in its development, was much more 'rank-heavy'. With our more normal range of experience we can let our senior captains and field grade officers in the F-35 focus on becoming great instructors and leading our airmen instead of doing jobs for which they are either underqualified or overqualified.'

Top: New blood – even the shiny new F-35As are starting to show a bit of wear and tear from pounding the ranges near Luke.

Right: Loaded with slick Mk82s, a Block 42 F-16C pilot prepares to head for the range.

When asked if he finds that F-35 pilots coming from one fighter platform are more suited to the task than pilots arriving from another type, Dougherty says, 'Based on the diversity of the F-35's capability, I've seen instructors from every fighter background both excel in their duties teaching and make huge contributions to the future of the community. In my opinion, adaptation to the F-35 and becoming an excellent tactician appear to be much more based on the individual than on their background.'

As the F-35 program continues to expand, more examples are arriving at Luke. While the 61st and 62nd FS both now have a full complement of aircraft, the F-35's capability carries on improving and upgrades are received with each production batch. As a result, the 56th FW continues to evaluate where each aircraft can provide the highest-quality student training. This sometimes means a jet will be moved from one unit to another, or even traded with other Lightning IIs from different bases. Furthermore, the 63rd FS is still receiving aircraft directly from the Fort Worth factory. Of course, over time, the 309th and 310th FS may trade their F-16s for F-35s, too.

Hail to the Lightning

Not surprisingly — and despite the undeniable success of the F-35 as a whole and the training program at Luke in particular — some critics remain, proclaiming the Lightning II overpriced and a failure. To the naysayers, Dougherty simply says, 'Across the board, pilots here at Luke are confident in the jet's future and wouldn't want to be in any other airplane if our nation called us to its defense tomorrow. It's an evolution in fighter aviation suited to the 21st century, capable of going places our fourth-generation fighters can't go.'

Dougherty says the new aircraft is like nothing else he's flown previously. 'You have information on ground and air entities within 100 miles available at the touch of a button. You can turn your head and have almost all that information displayed to you on the visor in front of your eyes. You can climb, dive, roll, pull, twist, turn and skid whenever you want. You can slow down to the speed of a NASCAR at Daytona or speed up to four times that speed. It is exhilarating, challenging, and intimidating, all at the same time. And boy is it fun!'

THE LAST TOMCATS

For the US Navy, the F-14 Tomcat is but a fond memory. However, these big cats still soldier on in Iran. In the first of a series of Tomcat features, *Combat Aircraft* looks at the F-14As of the Islamic Republic of Iran Air Force.

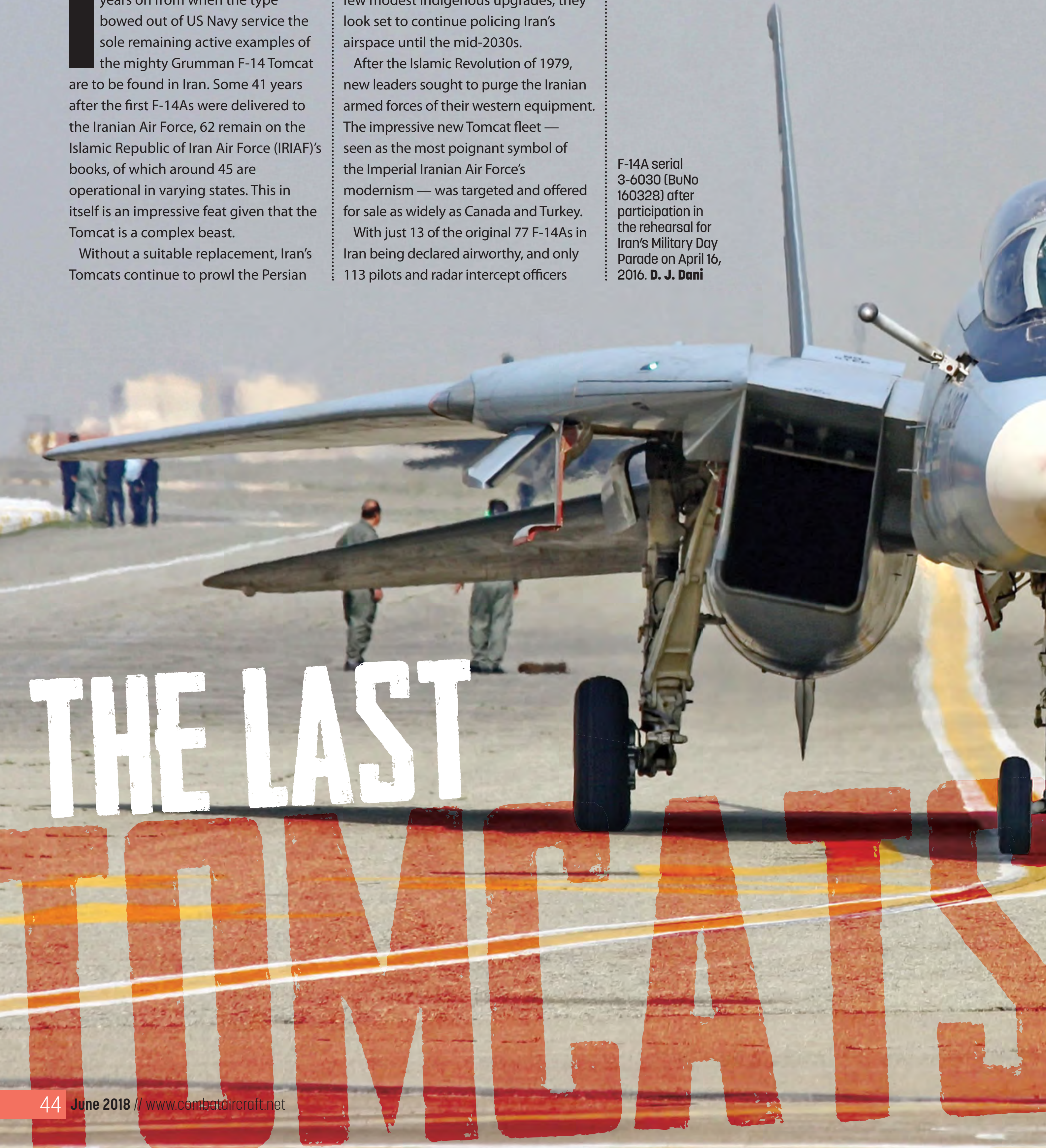
REPORT **Babak Taghvaee**

IT REMAINS ONE of the most revered of all fighter aircraft, yet 12 years on from when the type bowed out of US Navy service the sole remaining active examples of the mighty Grumman F-14 Tomcat are to be found in Iran. Some 41 years after the first F-14As were delivered to the Iranian Air Force, 62 remain on the Islamic Republic of Iran Air Force (IRIAF)'s books, of which around 45 are operational in varying states. This in itself is an impressive feat given that the Tomcat is a complex beast.

Without a suitable replacement, Iran's Tomcats continue to prowl the Persian Gulf, the Straits of Hormuz and the central Iranian Plateau. Equipped with a few modest indigenous upgrades, they look set to continue policing Iran's airspace until the mid-2030s.

After the Islamic Revolution of 1979, new leaders sought to purge the Iranian armed forces of their western equipment. The impressive new Tomcat fleet — seen as the most poignant symbol of the Imperial Iranian Air Force's modernism — was targeted and offered for sale as widely as Canada and Turkey.

With just 13 of the original 77 F-14As in Iran being declared airworthy, and only 113 pilots and radar intercept officers



F-14A serial 3-6030 (BuNo 160328) after participation in the rehearsal for Iran's Military Day Parade on April 16, 2016. **D. J. Dani**

(RIOs) suitably qualified, the IRIAF was forced to retain the F-14As as the Iran-Iraq war loomed in 1980. In the event, the Iranian Tomcats scored many kills against the Iraqi Air Force and Army Aviation Corps with their primary weapon: the big Hughes AIM-54A Phoenix.

The IRIAF lost 11 F-14As during the war. Among them were six shot down by Iraqi Air Force fighters (mostly Mirage F1s), while two were lost to 'friendly fire' surface-to-air-missile (SAM) shots. A further pair fell victim to technical failures and the last loss was down to 'an act of treason' as its pilot, Capt Ahmad Moradi Talebi, rebelled against the execution of his brother.

The Tomcat prevails

In 1981, IACI (Iranian Aircraft Industries) was contracted by the IRIAF to begin programmed depot maintenance (PDM) of the inactive (NORM, not operational ready for maintenance) Tomcats in a clear sign of their value. Seven years on and IACI had completed the overhaul of around 30 jets, of which 24 flew in a parade over Tehran on September 22, 1988. The event caused considerable confusion amongst western analysts, who mistakenly estimated that the parade included the sum total of Iran's Tomcat community.

Following the Iran-Iraq war, and on the orders of the IRIAF commander Gen Mansour Sattari, 16 fully mission-capable F-14As of the 8th Tactical Fighter Base (TFB) at Isfahan — amounting to nearly half the IRIAF's airworthy F-14As at the time — were redeployed to the 6th TFB at Bushehr to re-form the 62nd Tactical Fighter Squadron (TFS), its role being to protect Iranian airspace over the Persian Gulf. Sadly, it marked the start of a decline in the force. By 1996 just 11 aircraft were operational, and only two were fully mission-capable with operational AN/AWG-9 radars. The trend was attributed to a shortage of spare parts, the lack of a corrosion control shop at Bushehr and an inexperienced technical team in place

there in comparison to that back at the 8th TFB.

The 62nd TFS was disbanded in 2007 with six airworthy F-14As on strength — serials 3-6019, 3-6021, 3-6025, 3-6026, 3-6030 and 3-6058. The remaining jets were grounded due to excessive corrosion in their landing gear, control surfaces and electrical components. It spurred a further round of IACI overhauls; serials 3-6036 and 3-6037 are known to have been handled by IACI between 2007 and 2011.

According to the IRIAF's deputy director of operations, just 16 of the remaining 63 Tomcats assigned to the 62nd and 82nd TFS and the 83rd TTS (Tactical Training Squadron) were operational in 2006. Just five of them were fully mission-capable. Six more jets were in overhaul — three with IACI and three at the 8th TFB's Tomcat overhaul center — while 29 were declared as NORS (not operational ready for supply). The remaining 12 were all but dead and were being cannibalized for spares.

Renewed fortunes

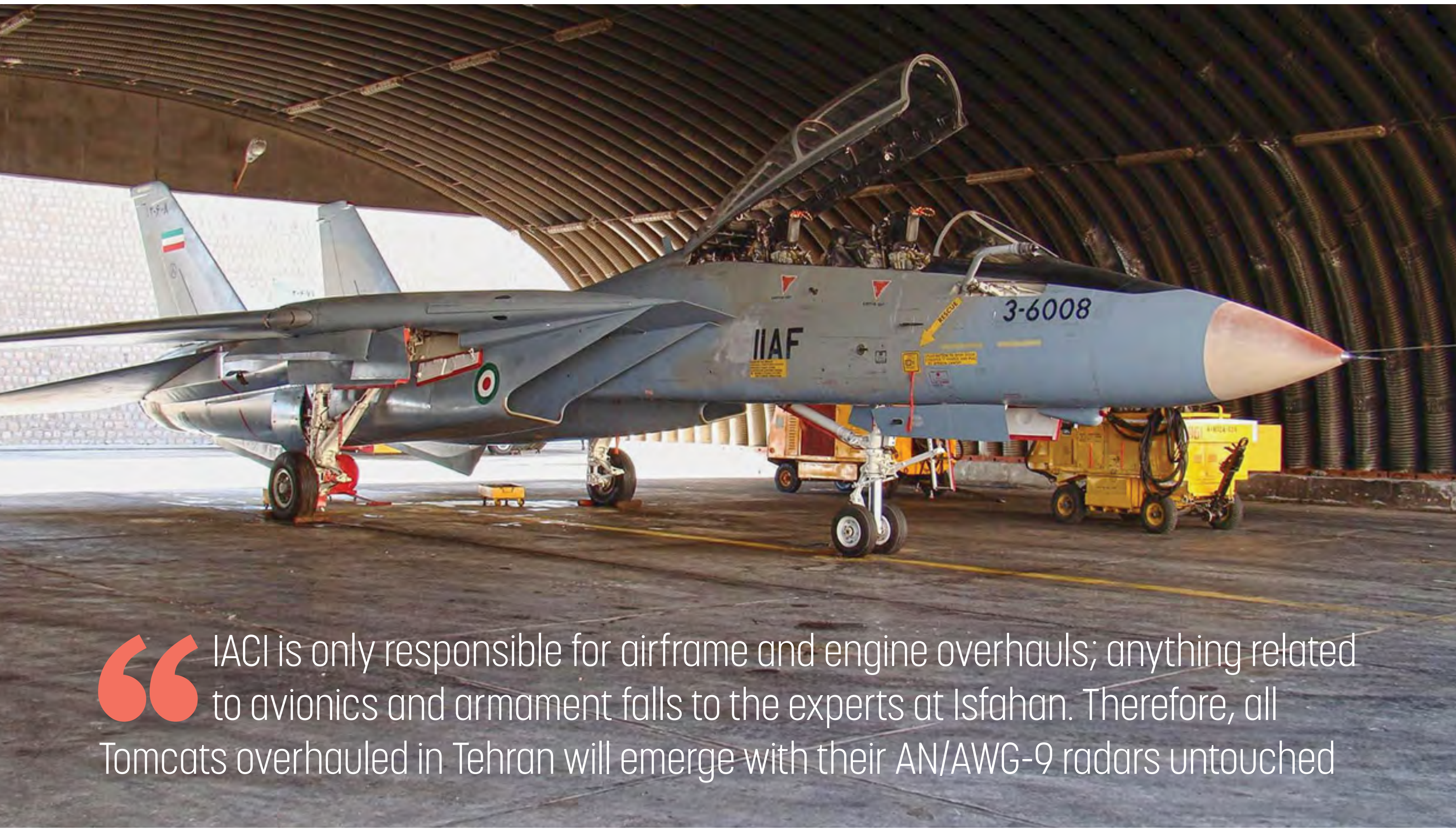
It was around the same time that the US Navy was getting out of the Tomcat business. As VF-31 'Tomcatters' and VF-213 'Blacklions' were parking their last F-14Ds in September 2006, several Iran-linked companies began procuring F-14 spares from storage facilities. Many of the valuable parts reached Iran. Indeed, in January 2007 the US Congress ratified a bill to prohibit direct and indirect sales of F-14 spares. In order to prevent further items from falling into Iranian hands it was ordered that all stored Tomcats should be scrapped. A shredding machine cut 154 aircraft into small pieces by August 2009, leaving just a handful of ex-US Navy Tomcats in museums.

However, Iran was already well under way with the restoration of grounded Tomcats. New spares enabled IACI to complete the overhauls of serial 3-6020 in March 2008, 3-6002 in June 2008,

Bottom: F-14A 3-6008 inside its shelter at Isfahan. **Babak Taghvaee**

Below: An impressive line of seven Tomcats for the Tehran parade of 2008. The aircraft comprise 3-6021 (now stored), 3-6062 (lost January 26, 2012), 3-6078 (active), 3-6045 (active), 3-6033 (stored), 3-6041 (under overhaul) and 3-6058 (stored). **Rahim Sharafi**

The famous F-14A 3-6002, which belly-landed at Isfahan in June 2008, back in action after being repaired. **Keyvan Tavakkoli**



> IACI is only responsible for airframe and engine overhauls; anything related to avionics and armament falls to the experts at Isfahan. Therefore, all Tomcats overhauled in Tehran will emerge with their AN/AWG-9 radars untouched

3-6036 in September 2008, 3-6042 in January 2009, and 3-6008 in May 2009.

F-14A serial 3-6002 was released by IACI and delivered to Isfahan at 14.30hrs local time on June 23, 2008. It reached Isfahan at around 16.00hrs, but the airfield was closed and the approach observer officer was therefore absent from the runway caravan. Unfortunately, the pilot neglected to lower the undercarriage and the Tomcat came to rest on its belly. The aircraft didn't appear again until 2012, following a further period of rework.

The advent of the new spares, plus new threats to Iran, spurred a rejuvenated Tomcat program. Between 2009 and 2016, even the six F-14s that were used as spares sources were carefully restored by experienced technicians at Isfahan, including 3-6016, which had been stored since 1998. Aircraft 3-6039 was also restored in 2012 and was the last F-14A wearing the original Asia Minor II camouflage.

By April 2008, the woeful 16-aircraft tally had grown to 23. Iran's Military Day parade on April 18, 2008 saw 15 F-14As heading for Tehran, with 12 jets appearing in four vic formations of three each. The final three aircraft were delayed on departure from Isfahan and didn't make the flypast.

Over the ensuing years, varying numbers of Tomcats have flown in the military parades, giving indications of the identities of active aircraft. Five took part in the April 17, 2016, parade: 3-6061, 3-6067 and 3-6071 in vic formation, and 3-6030 and 3-6041 on the wings of a KC-707.

In recent years, five Tomcats have been lost. Two were due to technical failure and two to pilot error, while the fate that befell 3-6062 on January 26, 2012, was somewhat mysterious. The aircraft was one of four aircraft with the callsign 'Yavar', armed with live AIM-9Js and AIM-7E-2s, that were forward-deployed to Bushehr in order to bolster the local quick reaction alert (QRA) provision. On the fateful night, the crew comprising Maj Alireza Karimaiee and Capt Mostafa Fasihi were scrambled to intercept an unidentified target, before the aircraft exploded over the island of Abbasak shortly after take-off.

Below: Tomcat 3-6054 flying in an exercise where it fired the first overhauled AIM-54A Phoenix. This aircraft has now been out of service for several years. **Abbasi**

Serial 3-6039 is the only F-14A that retains its original Asia Minor II camouflage. It is now in the queue for overhaul by IACI at Mehrabad International Airport. The aircraft is pictured in October 2016 being washed down after a simulated chemical attack. **Ali Naderi**

The remaining three F-14As at Bushehr were sent back to Isfahan, where they were grounded for inspection and overhaul to check for possible technical reasons for the crash. However, the Iranian Army Intelligence and Reconnaissance Command believes the aircraft was shot down by a US Navy warship.

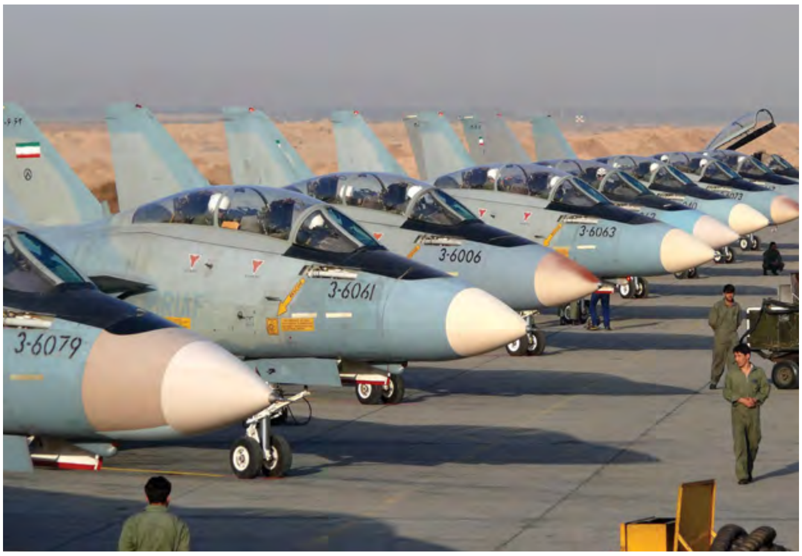
New life for old cats

Project 'Babaiee' was conceived to underpin the combat-readiness of the F-14 fleet, and to inject some much-needed new avionics and weapons.

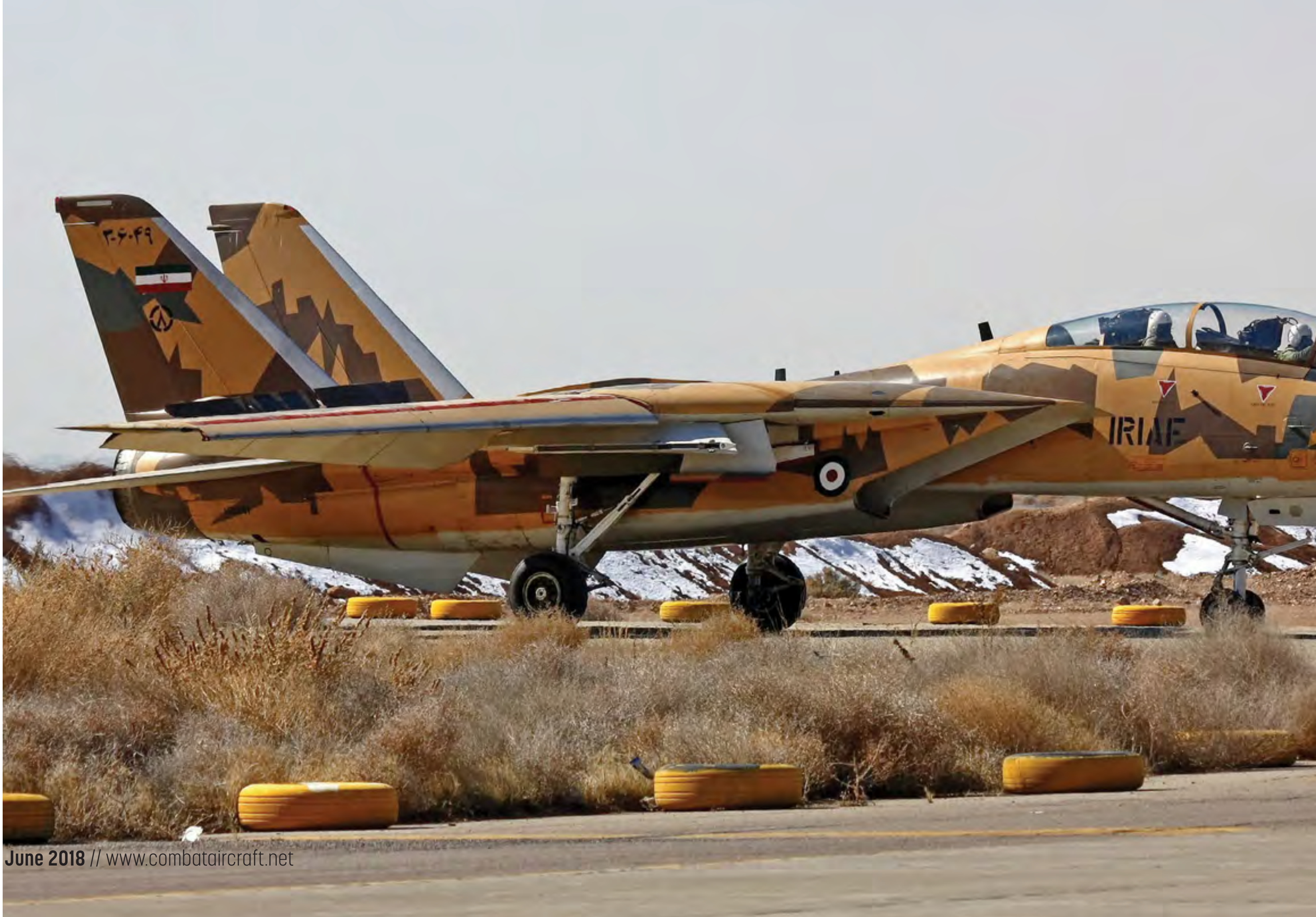
Tomcat 3-6049 was selected as the prototype for the work and arrived at Mehrabad on December 30, 2008. It heralded the start of a three-year project to not only restore the aircraft's AN/AWG-9 radar, but also to enable the carriage of new missiles such as the Shahin Havapayeh (an air-launched variant of the Shahin) and the Fakkur 90. While the IRIAF retains a small number of overhauled Phoenix missiles, they are hidden away for wartime use. The Shahin is essentially an AIM-23C Sedjil (the air-launched version of the MIM-23B) with a new radar seeker. The Fakkur 90 is an AIM-54A equipped with the guidance system from the Shahin. In 2008, the IRIAF successfully test-launched one of these missiles from Tomcat 3-6054.

It was planned to wire 3-6049 to carry and launch R-73E infra-red air-to-air missiles, but the lack of an infra-red search and track (IRST) system on the F-14A meant it had to rely on the AN/AWG-9 radar, which proved a step too far. There was also discussion about 3-6049 becoming an electronic warfare platform, equipped with the Sahab electronic countermeasures pod, but this too failed to gain traction.

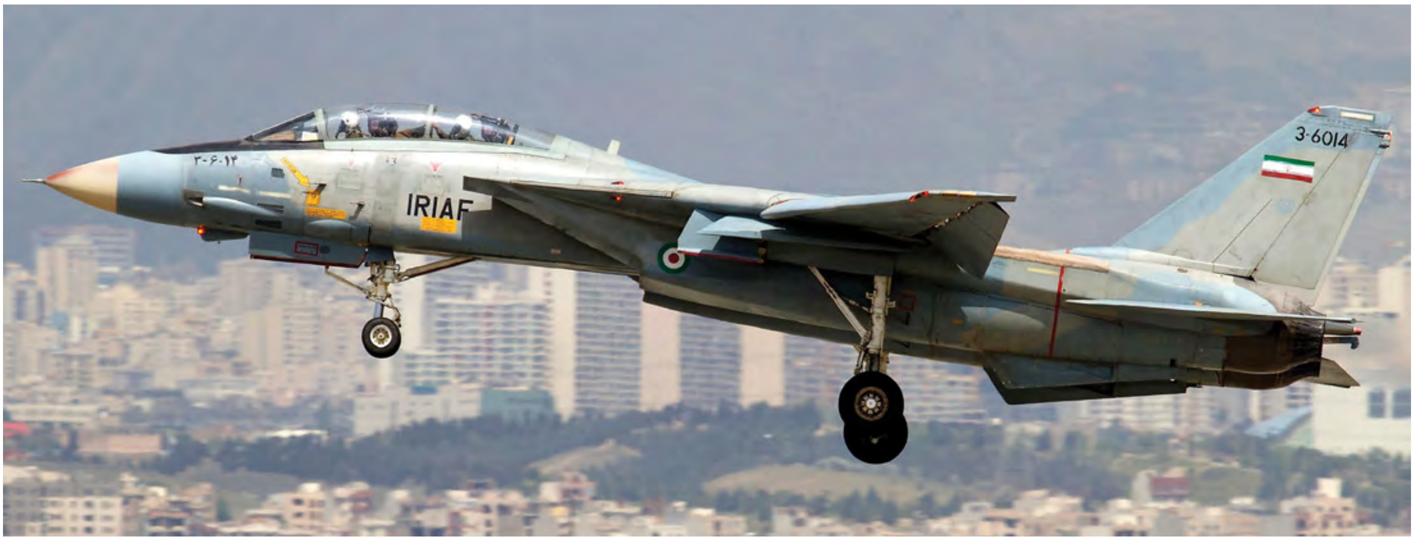
Eventually, the aircraft emerged as an F-14AM (Modernized) in a new Asia Minor II splinter camouflage scheme. It logged its first flight in this form on January 18, 2012 and was delivered to the 81st TFS in May 2012. The same procedure was completed on serials 3-6041, 3-6045, 3-6036 and 3-6046 at Isfahan from between 2013 and 2016. It is interesting to note that IACI is only responsible for airframe and engine overhauls; anything related to avionics and armament falls to the experts at Isfahan. Therefore, all Tomcats that undergo the overhaul process in Tehran will emerge with their AN/AWG-9 radars untouched.



Below left: Nine of the 15 F-14As that participated in the Military Day parade in 2008. Aircraft 3-6079 retained an original nose in the Asia Minor II scheme and was referred to as 'brown-nose' by its crews. Following overhaul in 2013 it received standard colors. **Rahim Sharafi**



Below: The first F-14AM (3-6049) wears a unique three-tone splinter Asia Minor paint scheme. **Keyvan Tavakkoli**

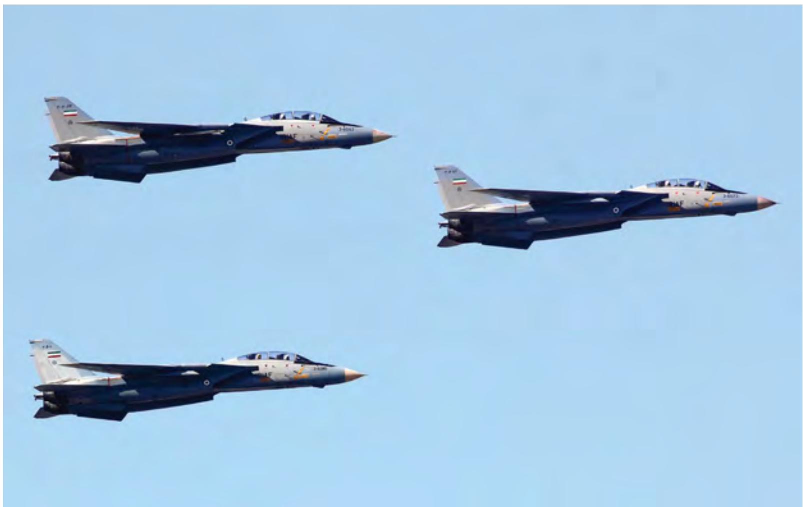


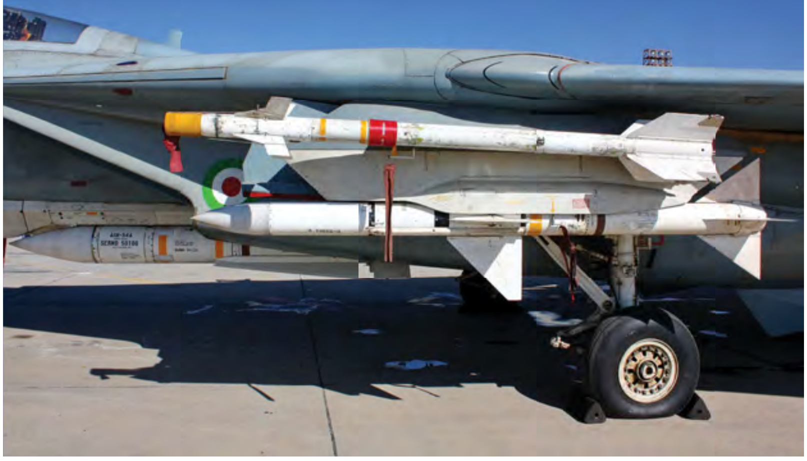
Recent action

On September 5 and 6, 2015, the IRIAF held the fifth instalment of its 'Devotees of Velayat's Territory' exercise at Isfahan. The first day saw F-14A 3-6061 flying combat air patrols and receiving fuel from a KC-707 tanker, while 3-6036 conducted dissimilar air combat training (DACT) with a MiG-29UB.

In October 2016, six F-14s were among the 60 participants, flying top cover armed with AIM-9Js and AIM-7Es as well as escorting strike packages. In addition, at least four of F-14A pilots had the chance to fire live AIM-9J Sidewinders and AIM-7E Sparrows at Karrar target drones, marking the first time in a decade that such actions had been undertaken.

In the face of international sanctions, the F-14 has soldiered on and still makes a useful contribution to Iranian air defense. While Iranian ingenuity has led to the innovative use of limited upgrades, it has also been able to overcome fatigue concerns, especially with the TF30-P-414A turbofan engines. It has used its engineers to good effect to redesign the compressor and turbine blades on the engines to prevent compressor stalls, which were common in low-thrust and low-speed regimes. With the improved engines, upgraded avionics and armament system as well as life-extended airframes, these Tomcats look set to remain in active duty with the IRIAF until possibly the mid-2030s.

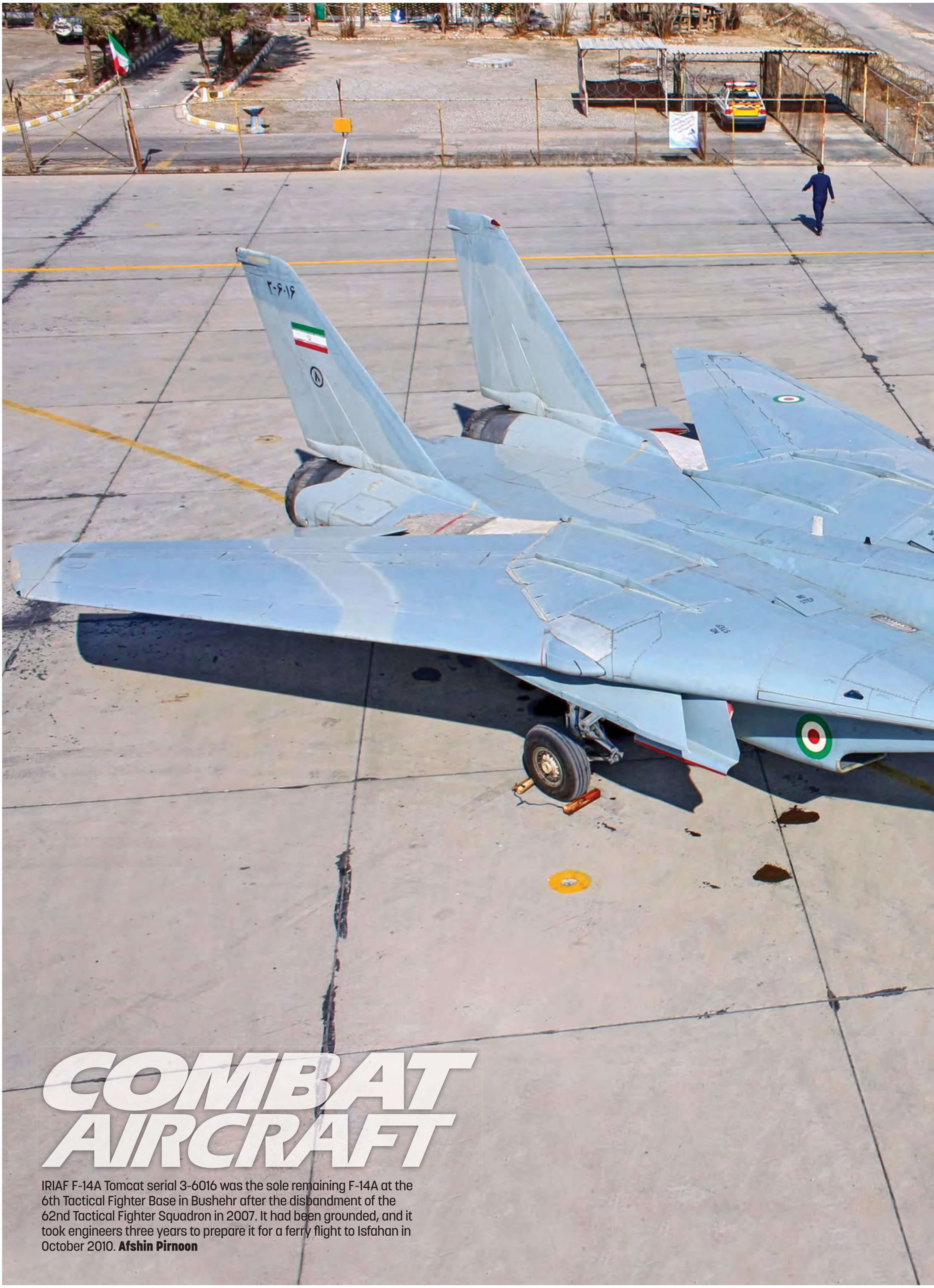




Top: 3-6014 landing at Mehrabad International Airport, Tehran. The aircraft is currently grounded pending overhaul. **Babak Taghvaee**

Above right: A vic formation of F-14As (3-6073, 3-6010 and 3-6063) during the Military Day parade in 2017. **Keyvan Tavakkoli**

Right: An impressive, if somewhat weathered, cocktail of weapons – AIM-54A, AIM-7E-2 and AIM-9J air-to-air missiles on an alert F-14A of the 81st Tactical Fighter Squadron at Isfahan in April 2014. **Keyvan Tavakkoli**



COMBAT AIRCRAFT

IRIAF F-14A Tomcat serial 3-6016 was the sole remaining F-14A at the 6th Tactical Fighter Base in Bushehr after the disbandment of the 62nd Tactical Fighter Squadron in 2007. It had been grounded, and it took engineers three years to prepare it for a ferry flight to Isfahan in October 2010. **Afshin Pirnoon**

NO STEP
IRIAF
RESCUE
3-6016

The unmistakable profile of the F-117A illustrated by a quartet of Nighthawks flying near Holloman AFB as the type prepared to bow out of service in 2008. **Rich Cooper**

NIGHT

The F-117 Nighthawk was retired 10 years ago. As *Combat Aircraft* marks the 75th anniversary of the Lockheed 'Skunk Works', we reflect on the Nighthawk's history and evaluate why a few F-117s continue to fly in secrecy.

REPORT **Paul Crickmore**

DURING THE BATTLE of Britain, the Royal Air Force demonstrated to the world the effectiveness of an integrated air defense system (IADS), albeit in a fledgling guise. It spurred a blueprint that was to be adopted by both the Eastern and Western power blocs. As the Vietnam War evolved, the US found itself facing a North Vietnamese opponent supported by both the Soviets and Chinese communists. As a result, US air arms lost the element of surprise and losses increased dramatically. To ameliorate against high levels of attrition, suppression of enemy air defenses (SEAD) tactics became an essential element of any strike package into defended airspace. Aircraft were used to create 'chaff corridors', while electronic attack aircraft attempted to jam enemy radars and communications as the newly formed 'Wild Weasel' units suppressed surface-to-air missile (SAM) and anti-aircraft artillery (AAA) batteries. As a result, by the end of the Vietnam War less than half the aircraft involved in major US air strikes were tasked with tackling the primary target.

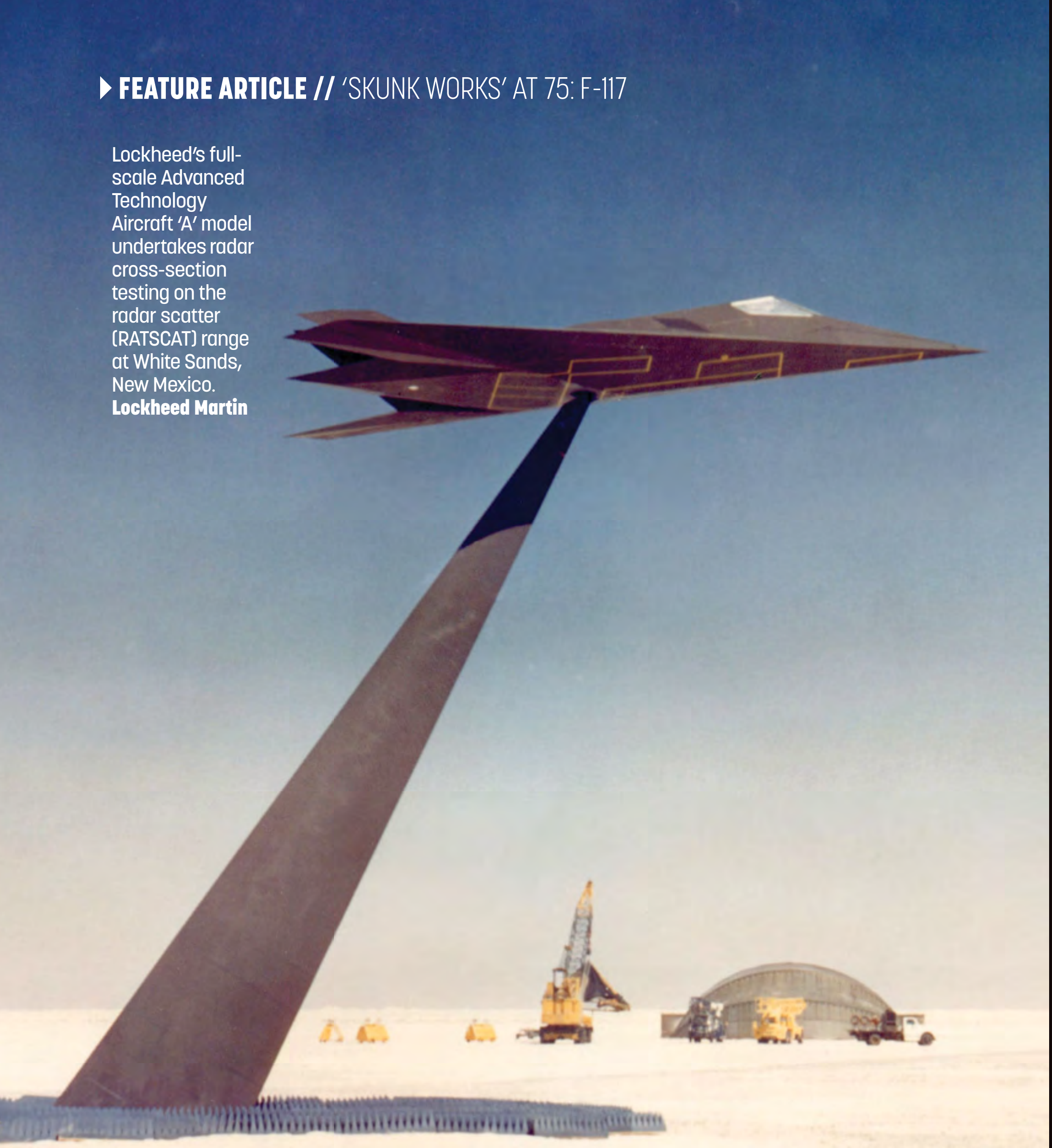
During the 1973 Yom Kippur War, the Israeli Air Force lost 109 aircraft in just 18 days, with most falling victim to radar-guided SAMs or AAA.

Pentagon analysts predicted that NATO air assets would be decimated in just over two weeks if all-out air combat broke out in Europe. A fundamental reappraisal of combat aviation in contested airspace became essential.

HAWK

In 1974, the US Defense Advanced Research Projects Agency (DARPA) set in motion a series of competitions that ultimately led on October 10, 1977, to a one-year $11.1-million contract for Lockheed to develop a concept for the Advanced Technology Aircraft 'A' (ATA 'A'). The very low-observable (VLO), single-seat attack aircraft was required to carry a 5,000lb payload and have an unrefueled range of 400nm. As the 'Skunk Works' team continued its assimilation, it became apparent that the elite Lockheed department had achieved a transformational reduction in radar cross-section (RCS) values, which generated an explicit operational advantage. Consequently, in summer 1978, USAF officials moved ATA 'A' to full-

F-117 pilots each earned a unique 'Bandit' number – there were 557 operational F-117 pilots. They started with 'Bandit 150', Maj Al Whitley; the last was the then Brig Gen David Goldfein, who was 'Bandit 708'. **Jamie Hunter**



Lockheed's full-scale Advanced Technology Aircraft 'A' model undertakes radar cross-section testing on the radar scatter (RATSCAT) range at White Sands, New Mexico. **Lockheed Martin**

scale development (FSD). It was a hitherto unprecedented move.

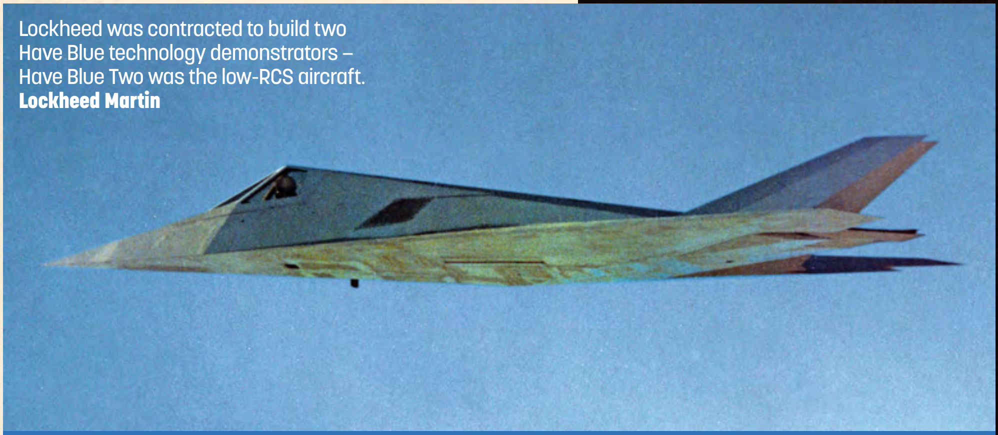
Covert funds were established and key government officials serving on various Senate committees were briefed on the program. In November that year, it was accorded the classified cryptonym Senior Trend, and Lockheed was awarded a full-scale engineering development contract for 20 operational airframes, plus five FSD aircraft.

Unprecedented secrecy

It was very apparent to both Lockheed and the USAF that the techniques and technology being ploughed into this revolutionary aircraft could be copied. This spurred unprecedented security measures to protect this 'perishable' asset. Even the F-117 designation didn't follow standard protocol. Instead, it was derived from the highly classified designations being used by the 6513th Test Squadron 'Red Hats' as cover identities for the covert evaluation of foreign aircraft. For example, a former Iraqi MiG-21F-13 'Fishbed' was redesignated as the YF-110B. Similarly, two ex-Syrian Arab Air Force MiG-17F 'Fresco-Cs' — known as 'Have Drill' and 'Have Ferry' — were dubbed the YF-113A and YF-114C respectively. Even the F-117s' serials bore no resemblance to 'white world' platforms; indeed, the prototype serial 780 was derived from its planned first flight date, July 1980, although that date would prove optimistic.

The unit chosen to fly the F-117 was the 4450th Tactical Group, formed on October 15, 1979. Referred to as 'A-unit', again to preserve security, it reported directly to Tactical Air Command's director of operations (DO), instead of a numbered air force.

While work on the prototype continued at Burbank, a comprehensive construction program began at the aircraft's covert operational base — Tonopah Test Range (TTR). Located in the north-west corner of the Nevada Test and Training Range (NTTR), this remote site was already home to the super-secret 4477th Test and Evaluation Squadron 'Red Eagles', operating Soviet aircraft as the ultimate adversaries to train front-line pilots.



Lockheed was contracted to build two Have Blue technology demonstrators – Have Blue Two was the low-RCS aircraft. **Lockheed Martin**

Lockheed chief test pilot Hal Farley ('Bandit 117') completed the prototype F-117's first flight from Groom Lake in the early hours of June 18, 1981. **Lockheed Martin**

Tonopah's runway was lengthened, a new control tower added, and fuel and weapons storage areas together with permanent housing and new hangars built. Construction at TTR was completed in early July 1982, and 20 A-7 Corsair IIs were hustled in to give the unit a handy cover story. Headquartered at Nellis AFB, they were referred to as 'P-Unit'. The 4450th Test Squadron was designated 'I-Unit' and Detachment 1 of 'A-Unit', based at Tonopah, was 'Q-Unit'.

Getting to Tonopah required a Monday-out, Friday-back commute from Las Vegas. This was handled by civil contractor Key Airlines, operating Boeing 727s, later replaced by Boeing 737s.

Aircraft serial 80-0787 was the first operational F-117 to be accepted by the USAF on August 23, 1982. It was joined 11 days later by 80-0786. That September, Det 1 of the 4450th was designated as the 4452nd Test Squadron with a complement of just two aircraft. On the night of October 15, Maj Al Whitley conducted his maiden flight, becoming the first operational pilot to fly the jet-black F-117. Whitley went on to command the Tonopah F-117 wing later in his career.

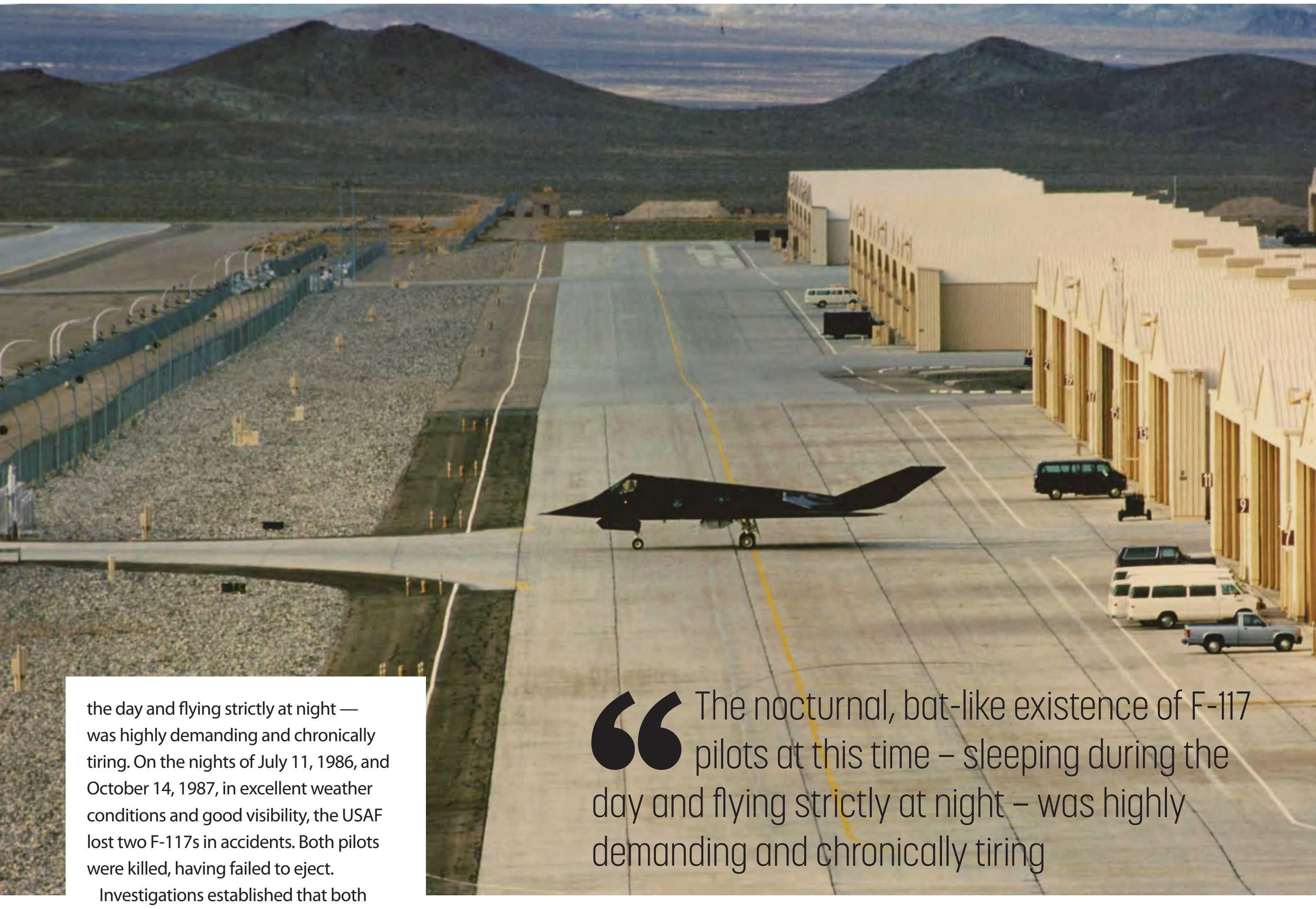
By October 28, 1983, Senior Trend was deemed to have achieved limited initial operational capability (LIOC). In acknowledgement of the type's potential, the procurement plan was increased to 57 aircraft (the final total was 59). The impact of this decision created the need for two additional squadrons. Consequently, in July 1983, 'I-Unit' 'Nightstalkers' was activated, followed in October 1985 by 'Z-Unit' 'Grim Reapers'. They were subsequently redesignated as the 4450th Test Squadron and the 4453rd Test and Evaluation Squadron respectively.

Right: All F-117s were built within the 'Skunk Works' construction facility at Burbank, California. **Lockheed Martin**

Below: This is the pre-OCIP III (Offensive Capability Improvement Program III) F-117 cockpit simulator. The green and white multi-function displays flanking the centrally mounted infra-red sensor display were replaced by color multi-function displays as a result of OCIP. **Lockheed Martin**

Setbacks

The nocturnal, bat-like existence of F-117 pilots at this time — sleeping during



The Tonopah hangars consisted of 'taxi-through' barns grouped in blocks of six. Note the uncompromisingly high barbed wire fencing separated by a well-lit, closely monitored 'dead zone' that isolated the flight line, hangars and other sensitive areas from the rest of the base. **Lockheed Martin**

> The nocturnal, bat-like existence of F-117 pilots at this time – sleeping during the day and flying strictly at night – was highly demanding and chronically tiring

the day and flying strictly at night — was highly demanding and chronically tiring. On the nights of July 11, 1986, and October 14, 1987, in excellent weather conditions and good visibility, the USAF lost two F-117s in accidents. Both pilots were killed, having failed to eject.

Investigations established that both aircraft showed no signs of mechanical malfunction and that the likely cause of both these horrific accidents was pilot fatigue and spatial disorientation. On October 20, 1987, Maj Bruce Teagarden ejected safely from his A-7D after the aircraft lost power. Unfortunately, the Corsair crashed into a Ramada Inn hotel near Indianapolis airport, killing nine people. Teagarden was cleared of all culpability, and although he was publicly acknowledged as being a member of the 4450th the unit was not known to have any links with Tonopah, ensuring that Senior Trend remained in the black.

However, these events served as the trigger to bring the F-117 out of the shadows. On November 10, 1988, at a Pentagon press conference, Assistant Secretary of Defense J. Daniel Howard held up a fuzzy photograph of the aircraft. Releasing its general shape allowed the 4450th to begin daylight flights, which led to a string of sightings. Easing Senior Trend into the 'white world' enabled the 4450th to retire its gas-guzzling A-7s, and in September 1989 it re-equipped with more economical AT-38Bs. Another change followed on October 5, 1989, when the 4450th TG and its component squadrons were re-designated. The parent designation was changed to the 37th Tactical Fighter Wing. The 4450th 'Nightstalkers', together with the 4451st Test Squadron, became the 415th Tactical Fighter Squadron (TFS) 'Nightstalkers' and the 416th 'Ghost Riders' respectively. The training unit, the 4453rd TFS 'Grim Reapers', continued its flight training responsibility but as the 417th Tactical Fighter Training Squadron (TFTS) 'Bandits'.

Combat debut

By the late 1980s, relations between Panama's military dictator Gen Manuel Noriega and the US had deteriorated after numerous incidents to a point where, on December 15, 1989, Noriega declared a state of war between the two countries. The George H. W. Bush administration decided to remove the despot and issued orders to implement Operation 'Just Cause' — the codename for the pre-planned invasion of Panama.

In support of the operation, at 14.00hrs local time on December 19, 1989, eight F-117s launched from Tonopah. Two airborne spares returned following completion of the initial aerial refueling. The decision to employ the F-117 was based upon its bombing accuracy (Panama didn't possess a radar defense network so the aircraft's stealth features were irrelevant). The 3,000-mile round trip from Tonopah to England AFB, Louisiana, required five aerial refuelings and was supported by KC-10s and KC-135s. Of the six aircraft in the strike package, two were airborne spares, while two were tasked to attack the Río Hato army base and the other two were designated to hit Noriega's residences at the Río Hato beach house and the La Escondida mountain resort.

In the event, the planned attacks on the dictator's residences were cancelled when intelligence reports indicated that the intended target wouldn't be at either. However, Maj Greg Feest, flying aircraft 816, and his wingman Maj Dale Hanner, dropped two 2,000lb GBU-27s

USAF

Left: When the 415th TFS deployed to King Khalid Air Base for 'Desert Shield' the term 'Team Stealth' was coined. Aircraft '821', named *Sneak Attack*, was the personal mount of Maj Wes Wyrick. It completed 32 combat missions during 'Desert Storm' and another 19 in 'Allied Force'. **USAF**

in an open field adjacent to the barracks. The purpose of the target selection was to stun and confuse, rather than kill, the sleeping soldiers before they had an opportunity to engage US Rangers parachuting in to occupy the Río Hato airstrip 90 seconds after the F-117 strike. Three hours before the invasion was due to begin, Noreiga's forces gained advanced warning of the impending invasion and deployed to the Río Hato airstrip. In the event, the bombing results were not as effective as had been planned. Several Rangers were killed and more than a dozen wounded in the ensuing firefight, before the island could be secured. As for Noriega, having initially taken refuge in a church, he was eventually extradited to Florida.

Operation 'Desert Storm'

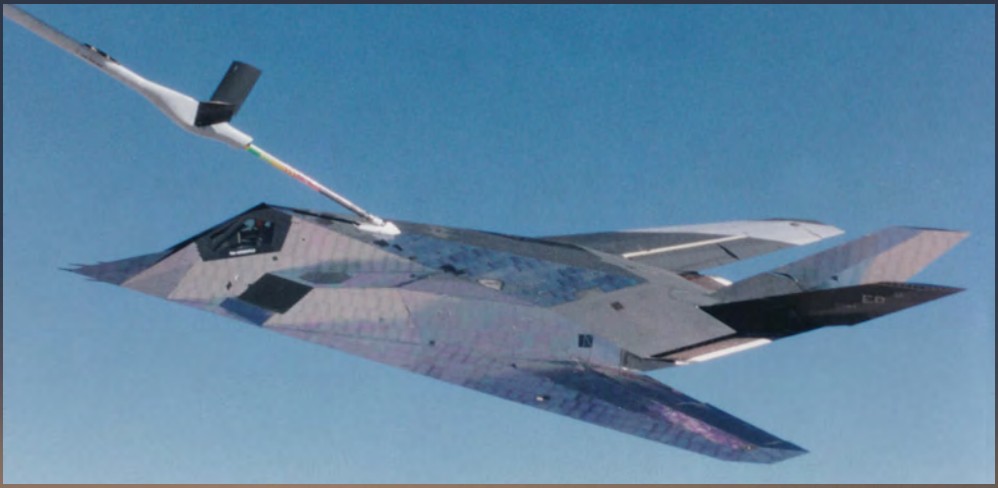
The F-117's true baptism of fire began on August 20, 1990. Following Iraq's invasion of Kuwait, the 415th TFS 'Nightstalkers' was ordered to deploy to King Khalid Air Base near Khamis Mushayt, Saudi Arabia, via Langley AFB, Virginia. An unprecedented 18 F-117s completed the move to Saudi Arabia in just 15 hours. King Khalid was well beyond Iraqi 'Scud-B' missile range, but the flying distance to Baghdad would necessitate three aerial refuelings per sortie, and a typical mission would last more than five hours.

The Iraqi IADS was sophisticated and its destruction was vital in order to disable Saddam Hussein's centrally controlled system. In excess of 400 observation posts were used to send basic heading and altitude data to a command post. This data was supplemented by 73 radar-reporting stations, feeding into 17 intercept operation centers (IOCs). Four sector operations centers controlled the IOCs, and from these three-storey, reinforced concrete hubs the defense of Iraq could be orchestrated. The defensive network was systematically dismembered by the F-117s from the outset. Key early warning radars and communications links were then dealt with by other, non-stealthy assets.

On December 4, 1990, the 'Ghost Riders' also deployed to Khamis. At 00.22hrs on January 17, 1991, the first of three waves of F-117s got airborne to deliver the opening salvos of Operation 'Desert Storm', an air campaign that would not only validate the success of the aircraft and of stealth technology, but would change the shape of air combat forever.

During the next 43 nights, 41 F-117s flew 1,247 sorties in 6,905 flight hours over the most highly defended targets in Iraq, achieving bombing results never before recorded. It all happened without the loss of, or damage to, a single jet.

Below: During a low-observable program – Senior Spud – consisting of just four flights in July 1993, aircraft 784 had the port side of its fuselage and the inside of the tail units covered in a textured metallic surface, which reflected light in a unique way. **Lockheed Martin via Tony Landis**



A trio of F-117s airborne from Holloman at sunset. Missions from Tonopah were initially flown exclusively at night, to preserve the secrecy of the project. **Rich Cooper**

Above: An F-117A in the 'Canyon' at Holloman in 2003, with a T-38A companion trainer taking off in the background. **Jamie Hunter**

Below: A pair of Nighthawks flies near White Sands, New Mexico, on a mission from Holloman. **Jamie Hunter**

The move to Holloman

With the F-117's incredible capabilities having now been demonstrated to the world, the aircraft took another tentative step out of the shadows when it was decided to relocate the fleet from Tonopah to Holloman AFB, New Mexico. Consequently, on July 8, 1992, the now 37th Fighter Wing (FW) formally disbanded and its assets were transferred to the 49th FW. The move to Holloman eradicated the need for Key Airlines to shuttle more than 2,500 personnel on 75 weekly flights to and from their place of work, saving millions of dollars per year. It also enabled the F-117 force to be fully plugged in to operational planning, as well as allowing its participation in a number of exercises.

On August 4, 1992, a Holloman-based F-117A was lost in an accident for the first time. The pilot ejected safely after aircraft 82-0801 entered an uncommanded roll and caught fire. A crash investigation identified the cause as an improperly reinstalled bleed air duct, which led to a hydraulic line malfunction to the flight controls and a fire.

Another unit redesignation in July 1993 saw the 415th and 416th Fighter Squadrons becoming the 9th FS 'Flying Knights' and 8th FS 'Black Sheep' respectively, followed in December by the 417th becoming the 7th FS 'Screamin' Demons'.

Another Nighthawk from Holloman was lost on May 10, 1995. Unfortunately the pilot of 86-0822 was killed and the subsequent investigation concluded that pilot disorientation seemed, yet again, to be the most likely cause.

Trouble in the Balkans

The end of the Cold War triggered the collapse of European communism and the subsequent break-up of Yugoslavia. A series of bloody wars in the region ensued in 1991 as states sought independence from Belgrade. Despite several UN resolutions and a UN Protection Force (UNPROFOR), sent to provide humanitarian assistance, the Serbs continued to gain ground. This eventually forced UNPROFOR to withdraw and NATO to launch Operation 'Deliberate Force' on August 30, 1995. A series of precision air strikes over 20 days against selected targets in Serb-held areas led to the so-called Dayton

Accord, which was signed in Paris on December 14, 1995.

Alas, in 1998, hostilities erupted in Kosovo and on January 30, 1999, NATO stated it would take whatever steps were necessary — including air strikes — to compel Serbian compliance with UN Security Resolution 1199. As NATO assets were built up in the area, the 8th FS deployed 12 F-117s to Aviano, Italy. When peace talks failed, the NATO Supreme Allied Commander Europe (SACEUR), Gen Wesley Clark, was ordered to initiate air strikes against the Federal Republic of Yugoslavia, signaling the beginning of Operations 'Allied Force' and 'Noble Anvil'.

These attacks began on March 24, 1999. However, significant political interference in the way the air campaign was fought, coupled with a series of electronic countermeasures shortfalls brought about by defense cuts, had dire consequences for the F-117.

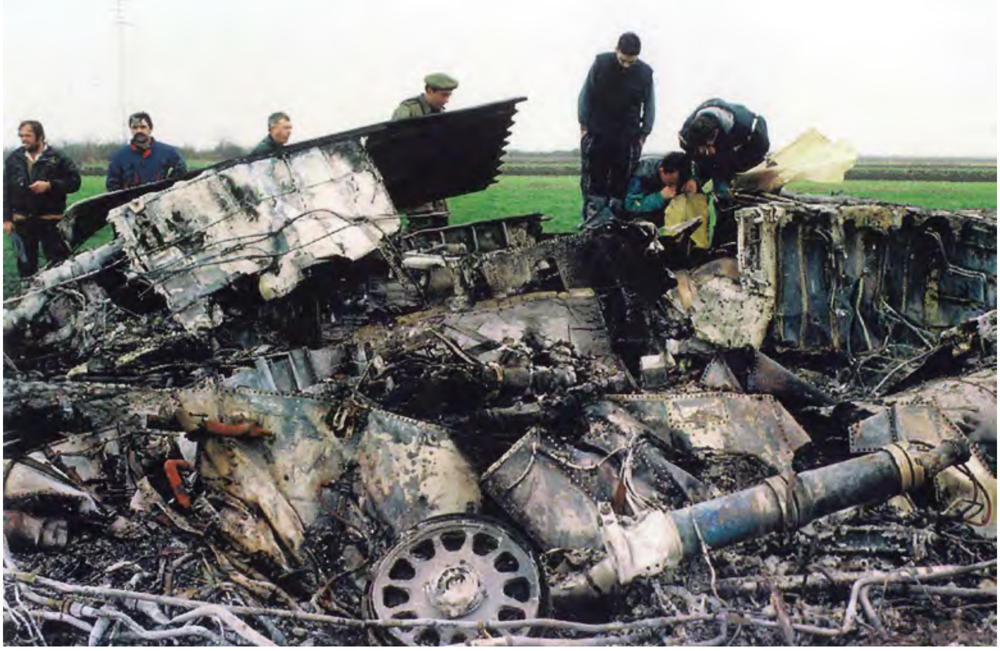
Lt Col Zoltan Dani was commander of Serbia's 3rd Battalion, 250th Air Defense Missile Brigade, equipped with S-125 Neva-M (SA-3 'Goa') SAMs. The redeployable system consisted of a P-18 'Spoon Rest-D' early warning radar, utilizing frequencies in the VHF A-band range of around 150MHz. This radar was used to initially locate a target in azimuth and range only. Once acquired, the target was handed over to operators of the 'Low Blow' missile guidance radar system using the I-band frequency range. 'Low Blow' then began its own target acquisition, resolving azimuth, range, elevation and velocity based upon details supplied by 'Spoon Rest'. Once acquired, 'Low Blow' was set to tracking mode, and at this point the system was ready to launch a missile. Having been fired, the missiles used guidance commands transmitted via radio datalink.

Aware of the looming conflict, Dani knew his unit would be targeted by allied F-16s and Tornados operating in the SEAD role. He therefore trained it rigorously, achieving a 90-minute total equipment breakdown in readiness to move off to another location. Mobility would be his key to survival. For additional insurance against High-speed Anti-Radiation Missile (HARM) attacks, he insisted that his unit restrict operation of its high-frequency 'Low Blow' radar for a maximum 20-second burst before shutting down.

On March 24, 1999, Dani received orders to move his battalion from Jakovo and deploy to an area near Šimanovci, west of Belgrade, where it would await further instructions. Three days later, on March 27, the unit was ordered to go to alert status. It was allocated four frequencies for the P-18 radar, to prevent potential interference with other P-18 sites.

Meanwhile, Lt Col Dale Zelko of the 8th FS got airborne from Aviano in F-117 serial 82-0806, callsign 'Vega 31'. Part of an eight-ship first-strike package, he was targeted to hit a well-defended air defense node in the southern suburbs of Belgrade. The weather was reported as being 'challenging', forcing the cancellation of other support/strike aircraft which — critically — included HARM-toting F-16s and Tornados. It's also understood that EA-6B Prowlers, scheduled to provide an electronic countermeasures cloak, were repositioned to cover a later B-2 Spirit strike.

Seated in front of the P-18's radar display, Dani received notification that aircraft were in the air. He ordered the P-18 to be activated, instructing his technicians to use the lowest of the four allocated VHF frequencies. Almost



Above: Lt Col Zoltan Dani and his team successfully engaged and shot down F-117 82-0806 flown by Lt Col Dale Zelko using the callsign 'Vega 31'. **via Paul Crickmore**

Below: An F-117 taxiing to the holding point at Aviano, Italy, prior to launching against targets in Serbia on the first night of 'Noble Anvil'. **USAF**

immediately the battery acquired four targets between 25-30km away. It was clear from the return characteristics that they were stealth aircraft. Soon, one of the targets entered the missile system's engagement zone and Dani ordered its acquisition with 'Low Blow'. Tracking manually, the operators initially caught sporadic glimpses of the return, before finally gaining a steady lock on the target. During this time Dani decided to transgress his self-imposed 20-second shut-down rule, since there were no non-stealthy returns in the area, thereby ruling out the possibility of a HARM attack. At 20.40hrs local time, 'Vega 31' had its bomb bay doors open (creating a large corner radar reflector) and was on its target run. An all-stations warning transmission from an E-3 AWACS advising 'Firefly-three, Firefly-three' — activation of an SA-3 site in Zelko's vicinity — was made. The Nighthawk fleet was not equipped with radar warning and homing (RWAH) equipment. Now, seconds away from release, Zelko concentrated on tracking the target through the downward-looking infra-red (DLIR). Once his GBU-27 had hit its target, he snapped 806's bomb bay doors shut and went into a hard, pre-planned left turn.

In the turn, the F-117's angular speed dramatically increased from Dani's perspective, adding further complexity to the intercept solution. But with the 'Low Blow' tracking radar engaged, Dani gave the order to fire a salvo of two V-601P missiles in a three-to-five-second interval.

Zelko recalls visually tracking two missiles as they blasted through the thin veil of cloud beneath. The first missile (the second to be fired), failed to lock on to the 'Low Blow' datalink and went into a ballistic trajectory, passing over the aircraft so close that its shockwave buffeted the Nighthawk. Re-acquiring the second missile, which was guiding, Zelko could see it was going to hit. Sure enough, the impact blew most of the port wing off, slamming the aircraft into a roll to the left and a -7g tuck. Zelko managed to eject, and just 1.8 seconds later he was hanging beneath a fully deployed parachute. Landing in a field near the village of Buđanovci, close to a busy road, Zelko's luck held. After some four hours on the ground he was plucked to safety by a USAF rescue team consisting of two MH-53s and an MH-60. The popular press carped that the

Right: Maj Bob Noonan goes through the technical log prior to a Nighthawk flight at Holloman in 2008.
Rich Cooper

Below: F-117A 81-0796, marked for the 49th Operations Group, on finals to Holloman in 2003.
Jamie Hunter

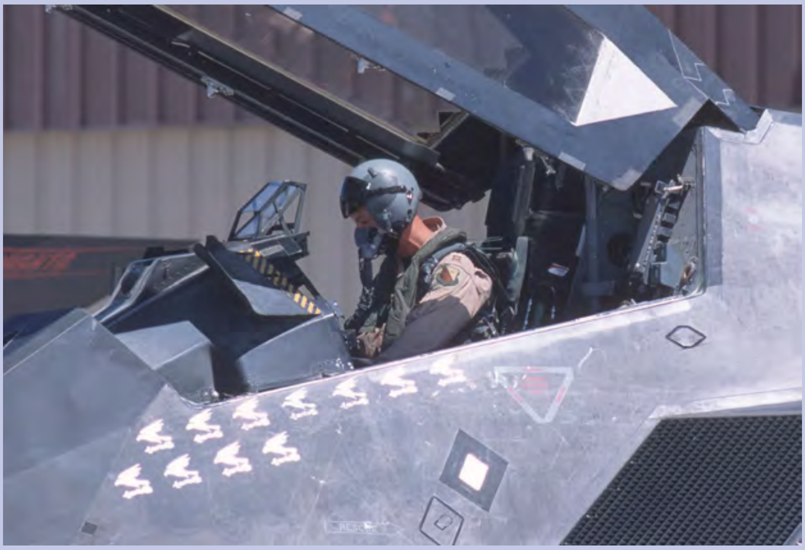
Nighthawk was no longer 'invisible', but neither the 'Skunk Works' nor the USAF ever claimed that it was. The F-117 was a highly effective, first-generation VLO platform.

On April 3, 1999, 13 F-117s from the 9th FS became involved in 'Noble Anvil' and deployed to Spangdahlem AB, Germany. It has recently come to light that an F-117 (possibly 82-0818) was damaged in another attack either by an SA-3 or anti-aircraft fire, sometime between April 4-9. The damage was such that it's believed to have required the pilot to divert. However, the incident remains classified.

'Noble Anvil' was brought to a successful conclusion and hostilities ended on June 10, 1999. During the 80 days of combat, F-117s completed 760 operational sorties. Yugoslav forces agreed to withdraw from Kosovo to make way for an international peacekeeping presence.

'Iraqi Freedom' and 'Enduring Freedom'

As Saddam Hussein continued to play cat-and-mouse games with UN weapons inspectors throughout the late 1990s, two F-117 deployments demonstrated US resolve. Then, citing intelligence information that would later prove highly controversial, it was claimed that Iraq had stockpiles of weapons of mass destruction (WMD). In 2002, the United Nations Security Council passed Resolution 1441, and — after yet more prevarication — allied patience with the Iraqi dictator came to an end. The stated political goal of Operation 'Iraqi Freedom' was the removal of Saddam Hussein's regime and to destroy its ability to use WMD or make them available to terrorists.



Above right: 81-0799 of the 9th FS completed 11 missions during Operation 'Iraqi Freedom'. It is pictured on its return to Holloman. **Lockheed Martin/ Denny Lombard**

On the evening of March 19, 2003, an intelligence report was received at short notice stating that Saddam Hussein and other top regime leaders would be staying overnight at the Dora Farms bunker complex south-west of Baghdad. The J-2 intelligence cell within the Combined Air Operations Center (CAOC) at Prince Sultan AB, Saudi Arabia, provided target information, including GPS co-ordinates. It directed that two F-117s of the 8th Expeditionary Fighter Squadron — under the 379th Air Expeditionary Wing, based at Al Udeid, Qatar — should be made ready for the strike and that each aircraft should be equipped with two EGBU-27 'bunker-busters'. These 2,000lb weapons featured a GPS/INS guidance system, enabling them to be dropped accurately through cloud cover without the pilot having to visually acquire and lase the target. But the weapons were very new to the F-117 and had never been tested before in combat — indeed, they'd only arrived at Al Udeid a mere 24 hours earlier.

Just two hours after receiving the intelligence report, an execution order arrived. A pair of 'One-Seventeens', flown by 8th FS commander Lt Col Dave Toomey and Maj Mark Hoehn, were airborne at 03.38hrs local time. Near Kuwait City, they rendezvoused with a KC-135 and topped up their tanks. They were joined by three US Navy EA-6B Prowlers to provide support and two HARM-equipped F-16CJs. Clearing the tanker, the two Nighthawks split up, taking different routes to their common target. Just 13 minutes after dawn broke over Baghdad, at 05.30hrs, each of the F-117s released two EGBU-27s through the early morning cloud, catching Iraqi air defenses completely off-guard. Post-strike reconnaissance revealed that the four bombs slammed into

Below: An F-117 returns to Al Udeid, Qatar, following the attempted 'decapitation strike' on Saddam Hussein's bunker complex at Dora Farms, south-west of Baghdad, on March 20, 2003. **USAF/SSgt Derrick C. Goode**

Above: During the afternoon of October 27, 2006, 25 F-117s performed a mass formation flyby at Holloman. **Lockheed Martin**

the underground bunker — situated beneath a field — just 50ft apart in a square pattern, leaving much of the earth above undisturbed. The bombs had worked as advertised and the two pilots each received a Distinguished Flying Cross for an outstanding mission executed with minimal lead times. Unfortunately for them, the weapon's intended target wasn't in residence…

On April 6, 2003, just 18 days after the start of 'Iraqi Freedom', the coalition leadership was able to declare complete air supremacy over all Iraq. Ten days later, the first humanitarian relief flight landed at Bashur air base. This action would prove to be the Nighthawk's final combat operation. In total, 82 missions had been completed, and the EGBU-27 had become the weapon of choice, 98 examples being dropped. It was undoubtedly a highly successful swansong, but the platform wasn't used in the 2003 Iraq campaign to the same extent as had been the case in previous operations, reflecting the number of other stand-off weapon system options now available to planners.

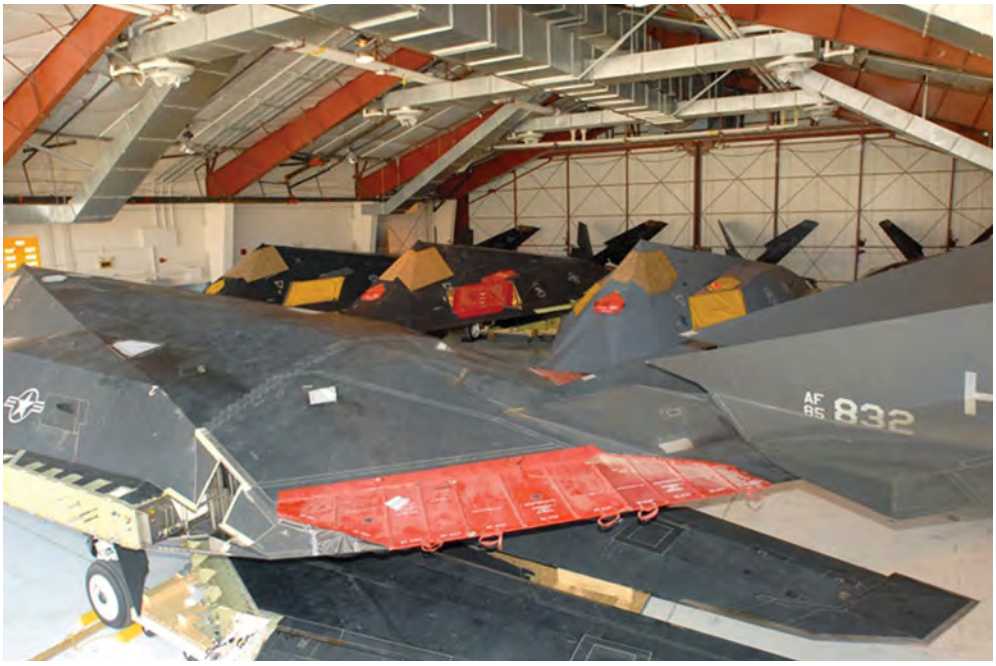
A swift end...

The legendary achievements of Lockheed's F-117 ensure that the aircraft's place in military aeronautical history is secure. But the relentless development and application of more complex computer modeling and other technologies surpassed those used in the facet-based stealth technology of the 1970s. Additionally, the changing political climate and ongoing defense spending cuts inevitably ensnared the F-117.

The USAF originally planned to retire the F-117 in 2011, but the platform was maintenance-intensive. In Program Budget Decision 720, dated December

Below right: Two F-117As photographed as they line up on the Tonopah runway in late July 2016. **The Aviationist/ Sammamishman**

Below: F-117 85-0835/OT of the 53rd Test and Evaluation Group was known as the 'Gray Ghost' during its final years of service as it wore a trial camouflage scheme. **Jim Haseltine**



Top: On April 22, 2008, the last four operational F-117s departed Palmdale for storage at Tonopah. **Lockheed Martin**

Above: Retired from active service, the remaining Nighthawks are stored in air-conditioned hangars at Tonopah. **Jim Goodall**

28, 2005, it was proposed that retirement of the entire F-117 fleet should be brought forward to October 2008, thereby enabling the purchase of additional F-22 Raptors to fill the void. The plan envisaged a two-phase drawdown, with 10 aircraft being retired during FY 2007 and the remaining 42 in FY 2008. It cited the presence of more capable low-observable assets in the inventory, which possessed an enhanced precision penetrating weapons capability, such as the B-2, F-22 and the AGM-158 Joint Air-to-Surface Stand-off Missile (JASSM). Implementation of the plan would save an estimated $1.07 billion.

Decommissioning of the first operational aircraft began on March 13, 2007, and the final wave was retired in a ceremony at the 'Skunk Works' on April 22, 2008. The F-117 formal training unit (FTU), the 7th FS, was deactivated on December 31, 2006, and 10 Nighthawks were grounded while their bed-down base was being prepared. Unlike most other US military aircraft, the F-117s wouldn't be going to the 309th Aerospace Maintenance and Regeneration Group (AMARG) at Davis-Monthan AFB, Arizona. Instead, due to many aspects of the aircraft still remaining classified, they would be retired to their original home at Tonopah.

Four F-117s remained with the 410th Flight Test Squadron at Palmdale for flight test purposes, but by the beginning of August 2008 just two remained. The last F-117 to leave was 86-0831, which duly flew to Tonopah on August 11. This marked the official end of Nighthawk operations.

On arrival at Tonopah, the aircraft had their wings removed and were placed at the back of their original, climate-controlled hangars. The F-117s were officially being kept in Type 1000 storage, indicating that they were maintained in a status from which they could be recalled to active service, should the need arise. This level of care clearly paid dividends, as four F-117s were reactivated as early as 2010, an online video of a low-flying Nighthawk proving the type's continued use. They have remained active ever since, engaged in a highly classified test program on the Nevada Test and Training Range (NTTR), which is believed to involve establishing baseline radar data in the continued development of new radar-absorbent materials. Such conjecture, however, remains highly speculative. Even so, the fleeting glimpses of F-117s in action to this day have been tantalizing for the ranks of Nighthawk fans.

The author wishes to thank Gabor Zord for his assistance with details relating to the shoot down of 'Vega 31'.

THUNDER OVER THE AE

GEAN

‘Iniohos’ in Greece is among Europe’s largest air exercises. *Combat Aircraft* went along to join the USAF in one of its missions.

REPORT **Ioannis Lekkas**

THE HELLENIC AIR Force’s ‘Iniohos’ exercise is fast becoming one of the most important events of its kind in Europe. A total of 76 fighter aircraft attended this year’s edition, which was again held at Andravida in south-west Greece. The annual two-week exercise focuses on strengthening partnerships and interoperability.

The flying phase officially began on March 12. What is 2018’s largest combat exercise in southern Europe welcomed six Royal Air Force Eurofighter Typhoons from No 3(F) Squadron for the first time. However, the bulk of the aircraft taking part were from the host nation, with almost the entire Hellenic Air Force being involved in one form or another.

The remaining complement included 13 F-15E Strike Eagles of the 492nd

A 492nd FS F-15E joins a pair of 336 Mira F-16Cs during a mission as part of ‘Iniohos 2018’. **All photos Ioannis Lekkas unless stated otherwise**

Fighter Squadron/48th Fighter Wing at RAF Lakenheath, UK, six Italian Air Force A-200 Tornados from the 6° Stormo, six United Arab Emirates Air Force Mirage 2000-9s operated by 71 Squadron and Leonardo Helicopters AW139 combat search and rescue helicopters from the Cyprus Air Force's 450 Squadron. Israel was once again involved, bringing a modest force of four F-16C Baraks for the last week — a significantly reduced presence when compared to previous years.

The main scenarios involved large force employment (LFE) packages of offensive 'Blue' air going up against an enemy 'Red' air force, which defended a piece of territory. The training missions undertaken included the suppression of enemy air defenses (SEAD), offensive counter-air/airfield attack, air interdiction/special targets, anti-surface warfare, target combat air patrol (TARCAP), high-asset value combat air patrol (HAVCAP), combat search and rescue (CSAR), dynamic targeting, strike co-ordination and reconnaissance, close air support and time-sensitive targeting.

This year's 'Iniohos' had two main differences compared with previous events. Firstly, all participating squadrons with an air-to-air capability were given the chance to join the 'Red' force, flying in mixed formations with HAF squadrons. Their mission was to defend their area of responsibility in co-operation with the ground forces and naval assets. Last year only two units acted as 'Reds' — the HAF's 330 and 337 Miras.

The second, and most important, feature this year was that missions were not independent efforts but part of a larger campaign that lasted almost two weeks and took place over the entire Greek territory. The latter characteristic is what makes 'Iniohos' a unique event — Greece offers large areas with a variety of terrain,

SPIRIT OF CO-OPERATION

Speaking at the 'Iniohos' closing ceremony on March 20, ADM Evangelos Apostolakis, Greece's National Defense General Staff chief, said: 'What has pleased me is the increased participation [in] the exercise. In just three years, we [have] managed to evolve 'Iniohos' into a major international exercise, which this year brings together participants from many countries. Saying that, I would like to cordially thank the Armed Forces of Cyprus, Israel, Italy, United Arab Emirates, [the] UK and US for their significant contribution with assets to the success of the exercise 'Iniohos 2018'. I would also like to express my appreciation for the participation of Egypt, with an observer.

'It is a fact that the versatile environment of [the] east Mediterranean constitutes this area as one of the most sensitive in the world. And nobody can face this reality alone. We need to co-ordinate and co-operate. And this is what we are doing here today.

'Exercise 'Iniohos' is a relatively new but very significant addition in our efforts to foster friendly relations and co-operation between armed forces who share concerns and face [the] same challenges. With this exercise we put another stepping stone in our endeavor to promote stability and peace in the area.

'So, today we bring together NATO and non-NATO armed forces. We bring together friends that are committed to safeguard peace. Today, we send a loud and clear message that we co-operate, that we are able to act efficiently together in a highly demanding and challenging operational environment.'

Below: An F-15E flies near Mount Olympus during the exercise.

Right page top to bottom: Fast jets from most Hellenic Air Force squadrons participated in the exercise including the newest F-16Cs from Araxos.

The Greek pilots took turns to play 'Red' aggressor forces and also partner with visiting assets.

Showing an impressive tally of mission markings from a recent combat deployment, this F-15E taxies out for a mission at Andravida.

> “Missions were carried out round the clock, with realistic attrition rates being set and very challenging scenarios that included multiple threats and were intended to invoke the ‘fog of war’. This tested all involved to the limits

from the northern borders of Macedonia to the remote south-eastern island of Kastelorizo.

Missions were carried out around the clock, with realistic attrition rates being set and very challenging scenarios that included multiple threats and were intended to invoke the 'fog of war'. This tested all involved to the limits, both physically and psychologically. The aim was to enhance the collaboration of the participants in a meaningful, effective and secure manner, and at a steady rhythm of battle.

Strike Eagle sortie

The presence of US Air Forces in Europe's F-15E Strike Eagles was one of the event's major highlights. *Combat Aircraft* had the chance to fly with the 492nd FS during the exercise, to gauge the effectiveness of a typical sortie. Lt Col Jeremy 'Maestro' Renken, a highly experienced aviator and the unit's commanding officer, was the author's pilot. 'The 'Iniohos' exercise gets better every year [with a] mix of challenging scenarios that exercise planners develop to test our skills in air superiority, close air support, interdiction and dynamic targeting,' he said, adding: 'This is an

Right: The UAEAF sent six immaculate Dassault Mirage 2000-9s. **Paul van den Hurk**

Below: F-16Cs from 341 Mira at Nea Anchialos and resident F-4Es at Andravida. **Paul van den Hurk**

'INIOHOS' 2018 MAJOR PARTICIPANTS

Hellenic Air Force	F-4E Phantom II Avionics Upgrade Program (AUP) F-16C/D Mirage 2000-5EG/BG EMB-145H AEWC
Israeli Air Force	F-16C/D
Italian Air Force	Tornado IDS
Royal Air Force	Typhoon FGR4
United Arab Emirates Air Force	Mirage 2000-9
United States Air Forces in Europe	F-15E

exciting period for the F-15E. Over the next few years we are modernizing our radars, upgrading to receive the AIM-9X, and a major upgrade effort known as EPAWSS [Eagle Passive Active Warning Survivability System] is under way to give the F-15E an entirely new suite of defensive capabilities.'

During *Combat Aircraft*'s mission, the Strike Eagles were joined by a pair of F-16Cs from 336 Mira 'Olympus', the task being to strike targets on a range close to the mountains west of Larissa. The sortie profile required a very low approach to the target area deep inside enemy territory, due to the presence of an integrated air defense system.

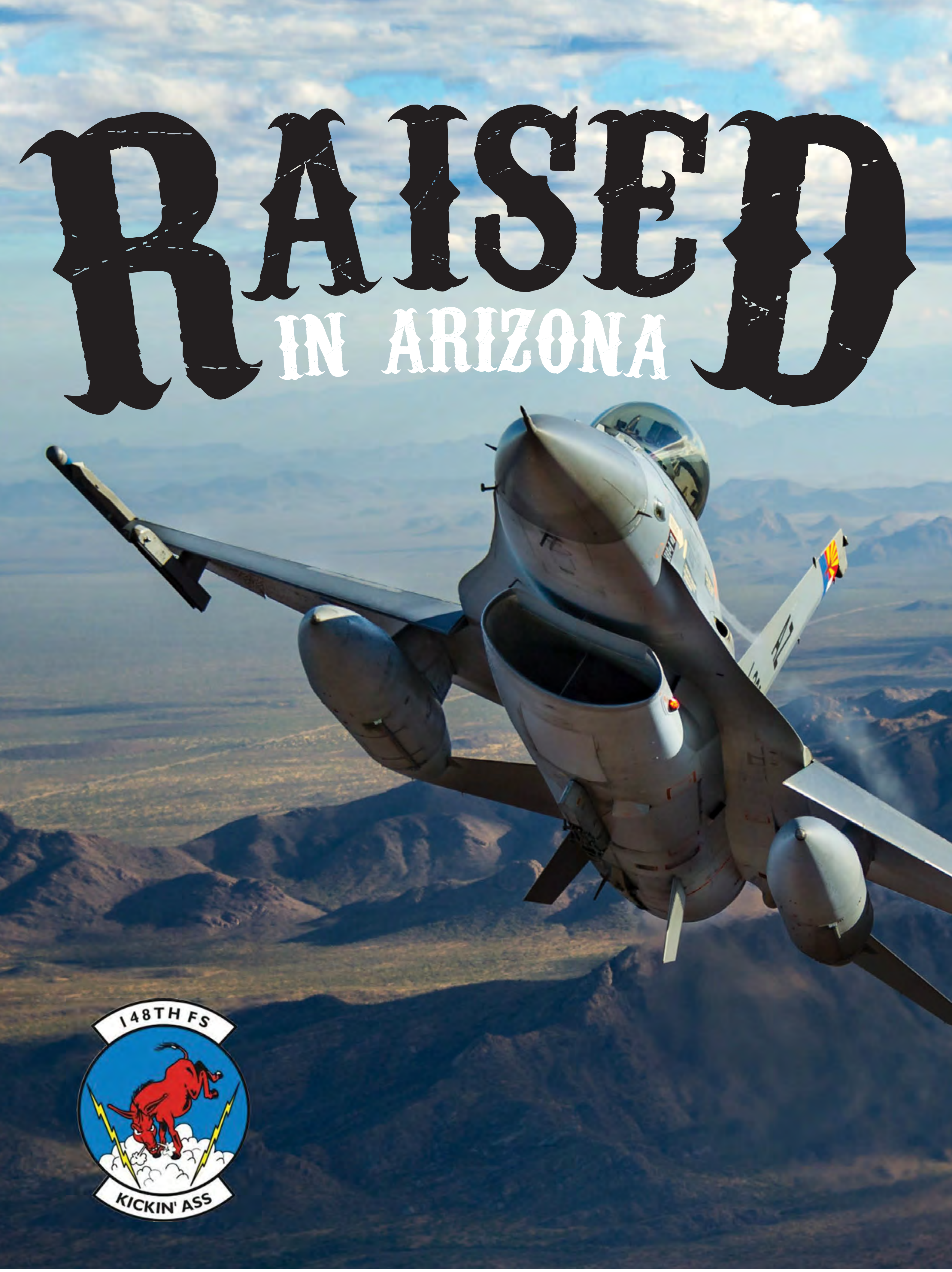
The 492nd FS crews weren't shy of expressing their admiration for the F-4Es of the locally based 338 Mira. The Phantom IIs flew alongside the F-15Es regularly, as well as aircraft from the Araxos F-16 units, 335 and 336 Mira. The F-15Es simulated the employment of a range of munitions including the GBU-31, -38 and -54 Joint Direct Attack Munitions (JSAM) and GBU-39 Small Diameter Bombs.

Right top to bottom: Six Typhoon FGR4s of No 3(F) Squadron at RAF Coningsby participated in 'Iniohos'.
Jens Schymura

An F-16C Block 30 of 117 'First Jet' Squadron from Ramat David.
Paul van den Hurk

Six upgraded Tornado IDS from 6° Stormo played pivotal roles in the strike element.
Jens Schymura

RAISED IN ARIZONA



The 148th Fighter Squadron is a unique element of the Royal Netherlands Air Force, training new F-16 pilots in the near-perfect weather of Arizona. 'Fight's on!'

REPORT AND PHOTOS **Rich Cooper/COAP Media**

THE MODERN FIGHTER pilot works in an era of multi-tasking, requiring quick reactions and swift decision-making amid high pressure and sensory overload. Bringing new blood into this extreme environment requires a mix of traditional, dyed-in-the-wool fighter pilot mettle blended with solid preparation for the front line of military aviation.

The 148th Fighter Squadron 'Kickin' ass' of the 162nd Fighter Wing, Arizona Air National Guard, primarily operates from Tucson International Airport. Its role is to train new F-16 pilots for the Royal Netherlands Air Force (RNLAF), and it's a community brimming with experience.

Squadron commander Lt Col Joost 'Niki' Luijsterburg is something of a 'Viper' master, recently becoming the first Dutch F-16 pilot to exceed 4,000 flight hours. He's something of a legend among the international fighter pilot community and has completed 12 combat deployments during his career — in the former Yugoslavia, including Kosovo, and Afghanistan — as well as being the senior Dutch representative and 'red card-holder' in the Combined Air Operations Center during a recent operation in the Middle East. 'Niki' has a passion for what he calls 'a life in the sky', something evident from his world record-holding skydiving accomplishments, which go hand-in-hand with his thirst for adrenaline. 'I have lots of interests and they're very diverse', he says. 'I love flying fighter jets, but I'm equally happy jumping out of airplanes, mountain-biking in the US wilderness, flying down a Swiss mountainside under a high-performance parachute. Or I could be on my couch watching movies with a bag of chips or reading a good book.'

Leading from the front

'It's been better than I expected,' 'Niki' says of his role teaching new aviators. 'I love sharing my knowledge and trying to get them to be a better pilot than I am — that's my main objective.' 'Niki' says he takes some of his inspiration from an outside source. 'I read a book on the New Zealand All Blacks rugby team. It talks about leaving a place better than you found it. I want to make my students better than I am and that's how we'll grow as an air force.'

Being an instructor is only as good as one's ability to impart information. 'Niki' explains that not only is knowledge important, but so is the rationale behind it. 'I like to give reasons why things are done or why they are not. Students are then more likely to follow it through and improve. Day-to-day, I'm just one of the IPs [instructor pilots] on the line. I fly the same amount as everyone else and am fully involved in the training of the young guys and have an equal share in that. I will hold the hammer on how we are going to do things overall, but everybody has their own job. I am not here to make the schedule or run the weapons shop, and I like it that way. If you have a job, you do your job — nobody wants to be steered any other way or have me interfering all the time. This would prevent growth and learning.

'Our squadron is fairly small. We have 10 Dutch jets with Dutch airworthiness

This image: With leading-edge slats deployed, a 'Kickin' Ass' F-16AM pulls up close to the camership above the rugged Arizona terrain.

Right: Looks can kill – a 148th FS student wearing the Joint Helmet Mounted Cueing System (JHMCS).

AZ

Lt Col "Niki" Luijsterburg
RESCUE
F-16A
SERIAL NO. 89-0010
SERVICE THIS AIRCRAFT WITH
GRADE JP-8 FUEL
PER MIL-DTL-83133
1. PUSH BUTTON TO OPEN DOOR
2. PULL RING OUT 6 FEET TO
JETTISON CANOPY
WARNING: THIS AIRCRAFT CONTAINS
A CANOPY REMOVER CONTAINING
AN EXPLOSIVE CHARGE

CESSNA

This image: Low and fast – the Arizona training areas and remote terrain enable the pilots of the Tucson unit to hone low-flying skills.

certificates, Dutch maintenance procedures and everything. Out of those 10, I have five two-seat B-models and five single-seat A-models. They're MLU [mid-life upgrade] standard, but they're officially Block 15 jets that are comparable to US Air Force Block 50 CCIP [Common Configuration Implementation Program] aircraft but without the HTS [HARM targeting system]. The US Air National Guard maintains my aircraft under a bilateral agreement.

'I have two maintenance liaison officers and I have one logistics officer. He runs the spare parts flow from the Netherlands [as well as anything else we need]. On the operations side I have five Dutch IPs including myself, plus three American IPs. We also have two mission planners, a simulator instructor and an administrative assistant. That's it. That gives me 12 people from the Netherlands in total and they are all permanently based here for three years, during which time they live here with their families.'

New blood

The Dutch contingent in Tucson welcomes four new pilots every nine months. 'With the 10 jets, we generate around 2,000 flying hours per year of which 1,200 are for the school,' says 'Niki'. Out of those 1,200, I use about 1,000 for my students, and that includes all the sorties that IPs are going to fly and any extra sorties that they need. The remaining 200 hours are for support sorties, such as for operational test work. For example, we undertook SDB [GBU-39 Small Diameter Bomb] operational test here. We do these types of things here because of the mostly perfect weather and the ranges we have [access to].

'The other part of the 200 hours are transition courses [TX] for people that come on an exchange tour, F-16 pilots that ran out of currency, guest pilots or people that have been away on a non-flying staff job for a period. I have roughly 800 hours remaining, which are allocated to operational RNLAF pilots that come out here. We have four come over to us every two weeks to take advantage of the flying environment under their own training requirements. It gives them a chance to focus on all kinds of different things than at home. It also means we export noise out of Europe. They can fly low over land here, where as at home they can only fly low-level over water. Here they have ranges where they can drop certain ordnance that we can't drop at home, so it's not just the great weather that we take advantage of. The weather predominantly comes into play with the students as they have more weather restrictions for landing and we need good weather for most, if not all, of their tactical syllabus missions. We have a strict syllabus and a strict [running] order, so having predictable weather creates the best continuity for a student pilot, and the training benefits as a result.

'We're a small team with a limited number of airframes, yet we're a very busy unit with a very high output and limited means.'

Even though the 148th is a busy unit, the ops tempo remains relatively low compared with the front-line units back home, and it's a predictable model. 'I know exactly what I'm going to do at any point of the month,' says 'Niki'. In an operational unit you don't know when the call will come that says you're leaving on Monday for three months. Life here is very stable even though it's hard work. It's a good

Below left to right: Lt Col Joost 'Niki' Luijsterburg in his office on the 'Viper' flight line at Tucson.

Getting airborne from Tucson International Airport for a training mission. **Frank Crébas/ Bluelife Aviation**

The Dutch contingent works with USAF maintainers to keep the 'Vipers' in top condition despite their age.

Best seat in the house – 'Niki' gets his 'Viper' down among the granite on a low-level sortie.

change of pace and is more family-oriented, with more stable personal lives.

'We have one deployment each class, which is a two-week visit to MCAS Miramar. We go there to train over water, which is really important as a lot of our flying at home is over water. If we only trained over land, where you always have great visual references, then by the time you undertake super-demanding missions at home over water without those great references, we find ourselves at increasing risk. All your visual references over water are completely different, so it's important to learn things like cross-checking the altimeter.'

Training to win

The winning formula is all about getting the most from the range of students that come here, all essentially to do the same job. 'Nobody gets a free ride,' smiles 'Niki'. 'We need to get them to a certain level of aggressiveness because we don't need people that don't think for themselves. We don't spoon-feed them everything. We let them explore and see what is right and what can and cannot be done. We'll be watching the entire way, sometimes really closely, sometimes at a distance, to see how things progress and steer where needed.

'There is a chance that you might lose people. You can never predict this in advance. Technically you might lose an entire class. This class right now started with five students, but one washed out during our dogfighting phase and not because he couldn't fly the jet or anything. He couldn't handle the g and that's something that you cannot predict. He might do OK tolerating 9g in a centrifuge, but everything is different when you pull the same amount and have to look over your shoulder, flip buttons, think, talk and

Above: The squadron operates a mix of five single-seat F-16AMs and five two-seat F-16BMs, all of which have undergone the European mid-life upgrade.

fly at the same time. You're processing all this information that is being given to you, while you're still listening to a controller, talking or listening to your flight lead, giving you instructions as you're breaking with 9g, and you're still looking at your radar and your HUD [head-up display] and your missile and all the information that is being presented to you and still be effective as a fighter pilot. So there's stuff that you cannot necessarily predict until we get to those certain phases. This proved too much for him physically and unfortunately we had to let him go. He's going to get another glorious career on the C-130, which is another great tactical platform, just with less g.

'Obviously, most attrition occurs before they even get to us. I believe there is a certain skill set involved but, yeah, if I have a period of years to devote to a student then I can probably get him to a certain level of flying the F-16, but he needs to able to do it in nine months. They need to be limited combat-ready, pretty much ready to deploy in nine months, and if he can't get there in nine months then this is not their job.'

Lt Martijn was the first RNLAF pilot to complete his initial training with the Italian Air Force. 'I don't think there is a lot of competition,' he says. 'You just want to be the best for yourself. We try to do as much as possible together, including the social side. On the operational side, we will discuss the things we learned; try to share the lessons learned, because if I fly a new sortie today and my colleague is flying the same one tomorrow then it's good for him to hear what I did wrong so he can improve before the flight and won't have to make the same mistake as I made.'

'We are a team, we're all going to cross the same border at the same time,' adds 'Niki'. 'In the 1980s everybody wanted to be the best and not share their knowledge. Luckily those days are gone. It's not very professional and it's not beneficial to anybody. I want to make everyone better than I am right now and better than I ever will be. Then everybody wins.'

Above: The Dutch team at the 148th includes instructor pilots, mission planners and a simulator instructor.

Below: A Litening pod-toting F-16BM punches out heat-seeking missile decoy flares.

All in a day's work

'On a typical flying day', Martijn describes, 'the squadron will fly two waves — the first will be students and the second will be the ops guys. Depending on where you are in the syllabus, we will usually find ourselves flying three times a week. The planning usually starts the day before, according to the syllabus you will be executing. We will then arrive at the squadron around 06.00hrs, grab a coffee, check the weather and the NOTAMS [notices to airmen] and any other special items like the emergency of the day, and then you go into the briefing with the instructor.

'The briefing will usually take little over an hour and we discuss everything from how we depart, how we come back and what we will do in the air. We make sure we cover every objective of the mission. For example, this week we began to learn air-to-ground, so we talked in extreme detail about what to do when and focused a lot on the switchology.'

Speaking to *Combat Aircraft*, Martijn is fresh from a 'turning and burning' air-to-air mission, red mask indentations evident

The F-16 will continue to serve the Royal Netherlands Air Force until 2025. It's been a solid performer on all levels.

on his face. 'The 'Viper!', he exclaims. 'In the beginning it was quite overwhelming. It's super-fast compared to what I was used to. It has many more systems, so you get a little overloaded in the beginning with all the stuff that you are learning — new weapons, radar, systems, but it was still great fun getting to know it. We start with the basics, just flying the jet, making turns, learning how to take off and land — basic flying. You start out single-ship and then on your third flight you go in a two-ship. Your first solo is the fifth ride. Thereafter the syllabus uses a stepping-stone approach to everything. In the air-to-air phase we start with dogfights, one jet fighting another within visual range. Then we progress to fighting another jet in a two-ship set-up. From there we go to intercepts and in the end we fight BVR [beyond visual range], where we employ long-range air-to-air missiles like the AIM-120 AMRAAM. Everything is done by a set number of flights.

'I just finished my air-to-air syllabus and am about to start the air-to-ground phase. I found it really challenging — it was such a big jump from what I had learnt so far and the benchmark for air-to-air here is really high. If you work extra hard and have the right mindset, you realize you can do it.

'We have a lot of nice sorties going on. We'll be hitting the range during the day and at night, we will be doing some

Above: As night falls, an F-16 student returns to the flight line wearing the daylight-only JHMCS. **Frank Crébas/ Bluelife Aviation**

Left top to bttom: A crisp echelon formation of 'Vipers' over the military operating area (MOA) near Tucson.

New meets old – an F-16AM from the 148th FS forms up with an F-35A from the Dutch operational test unit at Edwards AFB. **Frank Crébas/ Bluelife Aviation**

missions with a real air-to-ground scenario where you have to fight your way in, drop a bomb on the target and then fight your way out again. I'm really looking forward to those missions.'

New developments

In an interesting development, the current pilot course at the 148th includes a Norwegian student. 'Niki' says, 'The Norwegians normally have training slots with the USAF here in Tucson. But the US is suffering from a huge shortage of pilots, especially fighter pilots, so the USAF cancelled pretty much all of Norway's slots for the coming period to concentrate on its own requirements. Since we have a very close relationship with the Norwegian military, they asked if we could pick up one of their guys that graduated from Sheppard AFB, otherwise he'd be stuck for a long time until they could find a solution. We took up the role and allocated a slot.

'We love our relationship with our American hosts. Our American IPs are vital, plus the US maintenance guys are super-enthusiastic. We have a mix of extremely experienced maintainers walking around that were here when I first started as a student in 1991. We also have a bunch of young kids as well, so we have a nice mix of experience. I think we're a little bit more of a relaxed unit if you compare us to other units on base — and, yeah, I know that makes them very happy to work for us.'

As 'Niki' adds, 'Holland knows that, from an air force perspective, America is our most important partner.' F-16 training will continue in Tucson with the 162nd Fighter Wing until at least the end of the current contract period in 2022. After that it will focus on F-35A training at Luke AFB, near Phoenix. 'In 2019 we will start producing F-35 pilots, so there will be an overlap of about three to four years where we train F-35 and F-16 pilots at the same time, all in Arizona,' he outlines. 'By 2022, we will have trained the last F-16 pilot. By 2025 we will cease F-16 operations in the Royal Netherlands Air Force and we will close the curtain on what I think is the most successful combat aircraft that the world has ever seen to date. I don't think there has ever been a more successful or more capable fighter in the world that lasted this long. I think the F-16 is an absolute success story. Show me a piece of hardware that has worked that hard, that long and that successfully in Dutch defense history. There is none. It's unparalleled. It will be a very sad, but hopefully a very special and big day when that curtain finally falls.'

Bottom: Dutch pilots have had an outstanding experience with the F-16. It's little wonder they are so enthusiastic about the potential of the F-35A. **Frank Crébas/ Bluelife Aviation**

NEW PATH TO THE 'VIPER'

Lt Martijn took an interesting path to Tucson as he was selected to be the first RNLAF pilot to undertake his training under a new arrangement with the Italian Air Force at Lecce. This saw him and another student training (along with an IP) in the T-346 Master as a trial. It was an experiment that has been abandoned in favor of continued training at Sheppard AFB under the Euro-NATO Joint Pilot Training System, which it believes provides a stronger basis for future fighter pilots.

'We covered a lot of subjects; air-to-ground, air-to-air and of course just the basics,' says Martijn. 'We arrive there with only 30 hours of [Pilatus] PC-7 flying.'

The other Dutch students in Tucson had followed the traditional path through the T-38 at Sheppard AFB. Martijn could see a difference in a few areas from the two streams. 'We flew a lot of the same syllabus as the guys at Sheppard, but I think they focused a little bit more on the air-to-air than air-to-ground during IFF [introduction to fighter fundamentals]. Because Italy has a lot of air-to-ground assets they fly a lot of that, so that's one of the differences that we encountered. I'd say the guys from Sheppard were a little better-prepared for the air-to-air phase in the beginning, especially in the within visual range phase, but after that the all-new tricks like BVR and the sheer range of sorties was new ground for all of us.

'It's always difficult in the beginning because we don't know the systems or how to fly the tactics. Sure, we know certain elements, but we don't always know why we do it because we are still forming the bigger picture — we might be being taught a specific maneuver, for example, and we won't know why this particular maneuver is useful until it becomes clear later in the syllabus. You learn as you go, with those explanations coming along the way, and I'm enjoying putting it all together.'

Below right: Lt Martijn came to the F-16 from a lead-in fighter-training course on the Italian T-346 Master.

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FABULOUS FALLON

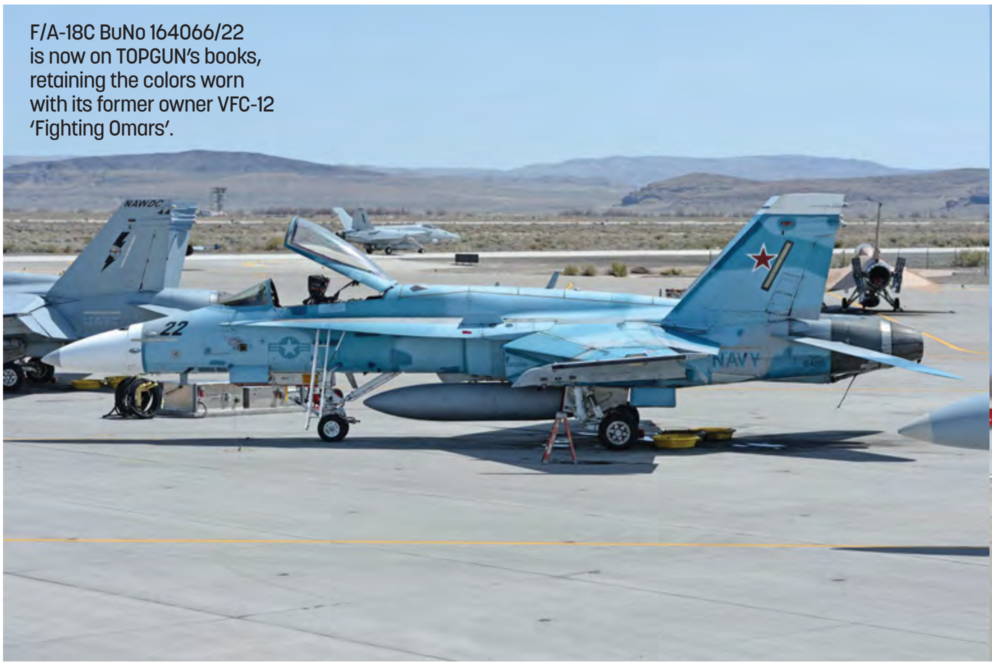
NAS Fallon in northern Nevada is one of the most important air stations in the US Navy. In the first of a series of features, *Combat Aircraft* goes behind the scenes at this air power haven.

REPORT AND PHOTOS **Jamie Hunter**

FEW LOCATIONS ARE as important to US naval aviation as NAS Fallon, located in a remote corner of northern Nevada, about an hour east of Reno. The small farming community here has been boosted by the manpower that the adjacent airfield demands, with some of the navy's most important tactical training being conducted on the sprawling range complexes to the east and south of the field.

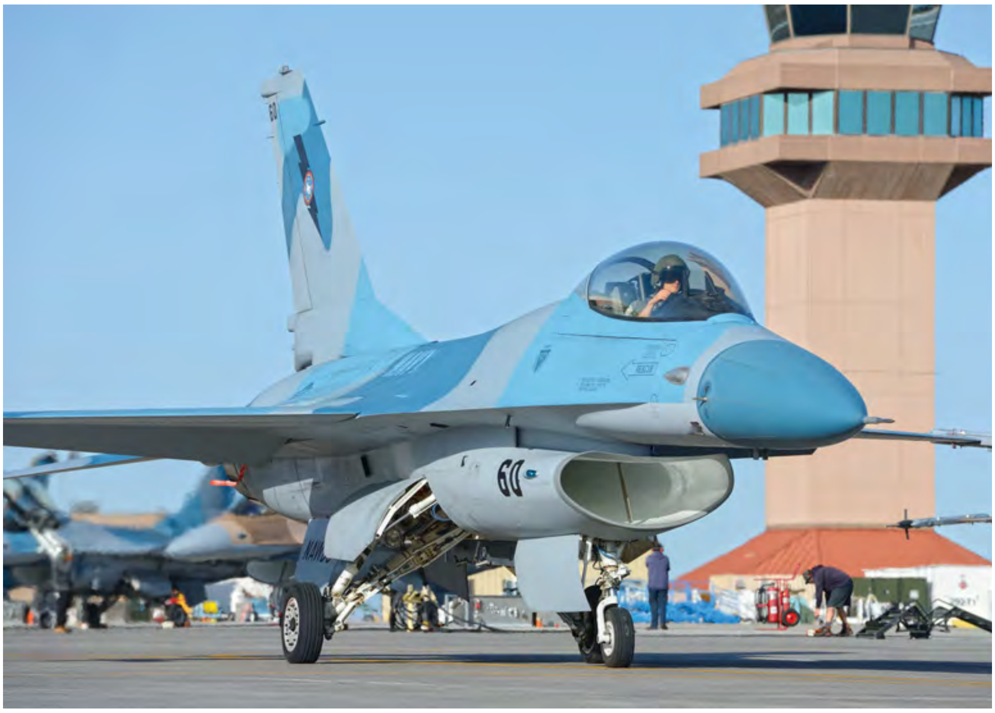
Pivotal to all flying activities at Fallon is the Naval Aviation Warfighting Development Center (NAWDC, pronounced 'nor-deck') which serves as the umbrella organization for a number of specialized training and tactical support branches. It takes in the 'HAVOC' electronic attack weapons school and the famous TOPGUN Strike Fighter Tactics Instructor (SFTI) course.

Fallon's bad guys – a VFC-13 F-5N is hunted down by instructors from the famous TOPGUN school in their F/A-18C and F/A-18F adversary aircraft.



F/A-18C BuNo 164066/22 is now on TOPGUN's books, retaining the colors worn with its former owner VFC-12 'Fighting Omars'.

NAWDC's 'HAVOC' Airborne Electronic Attack Weapons School operates its own EA-18G Growlers.



In addition, the station is home to VFC-13 'Saints', which flies the F-5N/F Tiger II in the fleet support role. This squadron is tasked with providing adversary 'Red Air' for a range of customers, including certain elements of the TOPGUN course and for visiting fleet squadrons.

Fallon is all about tactical training — therefore, it forms an integral element of unit work-ups prior to combat deployments. Squadrons come here for unit-level evolutions such as the Strike Fighter Advanced Readiness Program (SFARP) training syllabus, which is intended to maximize the tactical proficiency of strike fighter aircrews across the full spectrum of mission sets. The base hosts Air Wing Fallon, where the entire Carrier Air Wing (CVW) comes together to hone its joint warfighting skills, one of the final phases of training ahead of a cruise.

In forthcoming issues, *Combat Aircraft* will detail the various aspects of operations at NAS Fallon, including details of VFA-103 on SFARP and culminating with an exclusive behind-the-scenes look at TOPGUN, which marks its 50th anniversary next year.

Above: One of the new TOPGUN F-16A schemes. The lightweight and fast F-16 serves as a useful adversary aircraft to test TOPGUN students in air combat.

Right: Selected TOPGUN instructors are selected to fly the school's stunning F-16A/Bs in the adversary role.

VFA-143 'Pukin' Dogs' was at NAS Fallon with its F/A-18Es in April alongside its sister squadrons from CVW-7 for the unit-level SFARP evolution.

ANY TIME, ANY PLACE, ANYWHERE

The Travis-based 60th Air Mobility Wing's mission is to rapidly project American power around the world at a moment's notice. Without the likes of the 6th Aerial Refueling Squadron's KC-10A Extenders, it would be an impossible task.

REPORT AND PHOTOS **Ashley Wallace**

KNOWN TO AIRCREWS as the 'Gateway to the Pacific', more passengers and cargo pass through Travis AFB's cavernous military air terminal in each year than any other in the United States. Located in the San Francisco Bay area, three miles east of Fairfield, Travis is home to the 60th Air Mobility Wing, the largest organization of its type in the air force. Its mission is simple — to rapidly project American power around the world as required, any time, anywhere. On top of that, it is responsible for global strategic airlift and aerial refueling.

The 6th Air Refueling Squadron (ARS) operates 27 McDonnell Douglas KC-10A Extenders in the air-to-air refueling tanker and airlift roles. *Combat Aircraft* spoke to Maj Bob Budde, a KC-10 pilot and evaluator assigned to the unit. 'I completed my flight training in 2005 at Laughlin AFB, Texas, and began my career with the KC-10 at Joint Base McGuire-Dix-Lakehurst, New Jersey. After four years at McGuire flying across the globe in the USAF's premier heavy tanker, I returned to Laughlin to teach students basic flight skills in the [Beechcraft] T-6 Texan II trainer. After four years, I was reassigned to Travis to resume flying the KC-10. I now have 2,500 hours' flight time on the type.

'The KC-10 is the only mission design series that I've been assigned to. I understand that there are advantages to other aircraft in the [USAF] fleet; however, I've always enjoyed the mission of the KC-10. We are consistently called upon to travel the world, enabling the USAF to achieve true global mobility.'

Most operational sorties involve the movements of fighter, bomber and transport aircraft across the US and around the globe. For example, the 6th has a major commitment in the Pacific region supporting aircraft that need to transit considerable distances between America, the various islands and other allied bases across Asia. While most of these assignments involve extending the range of other aircraft and supporting them as they transit to their destinations, the KC-10 can carry cargo when space and weight allow. The Extender has proved itself time and time again to be an incredibly flexible platform.

Flying the KC-10

'The Extender is surprisingly responsive,' says Budde of the aircraft, which is based on the commercial DC-10. 'The flight

controls in the [Raytheon] T-1A Jayhawk advanced trainer, which we fly during our undergraduate pilot training as preparation for flying larger aircraft like the Extender, require firm and deliberate input. However, the hydraulically powered flight controls aboard the KC-10 provide instant and crisp feedback. It often feels like you're flying a much smaller aircraft. This is useful when maneuvering close to other aircraft as the KC-10 not only provides fuel but can receive it from other tankers as well. Having two large aircraft connected in flight requires both steady hands and a great degree of confidence in your aircraft. The KC-10 definitely provides that confidence.'

The basic Extender crew consists of two pilots, an aircraft commander and a first pilot, plus a flight engineer and boom operator. Due to the 6th's incredibly busy training and operational mission requirements, a crew complement often exceeds the basic number for good reason. Having a larger team on board enables personnel to focus on and participate in specific aspects of an assignment, ensuring the maximum is achieved during each flight. Occasionally, the crew size will increase to enable longer operational working days to be completed, sometimes up to 24 hours. In this situation, additional team members will use the on-board bunks and galley to rest up and recharge before returning to their seat.

The KC-10 and Boeing KC-135 Stratotanker are the workhorses of Air Mobility Command. Budde gave his view on the advantages of the Extender compared with the Stratotanker. 'Sometimes you just need a bigger hammer! The KC-10 does have a significantly larger fuel load [roughly twice that of the KC-135 when both are fully loaded]. While the KC-10 is not only larger and able to carry 156,000lb [70,760kg] more fuel than the KC-135, it is equipped with an aerial refueling boom and a hose and drogue centerline refueling system. This enables us to refuel aircraft from any branch of the US military and those of our allied nations, too — potentially during the same flight. The KC-135, in comparison, can only [have] either one system or the other on any given flight [on its centerline flying boom]. Having both systems provides more options when matching tankers versus receiver aircraft, whether this takes place over the battlefield, moving aircraft around the globe or during local training flights.'

Budde highlighted one memorable Extender mission where the type excelled. 'Soon after I started flying the KC-10, the incredible flexibility and capability of the aircraft was evident when we were called upon to support a fighter squadron during a flight from their home base in Florida to a training exercise in Nevada, a journey of over 2,000 miles [3,200km]. The intention was to complete this in one day, non-stop. Our aircraft was able to hold enough fuel and cargo to get not only itself there, but four fully loaded fighters, 60 of their maintenance personnel and many pounds of support equipment and spare parts. With a few KC-10s, you have the ability to pick up an entire fighter squadron and move it across the country or even an ocean — a feat I continue to find extremely impressive.'

Maintenance and upgrades

The high operational tempo throughout the air force places great strain on the KC-10s at Travis. The 6th ARS' engineering

KC-10A serial 83-0078, callsign 'Quest 65', on short finals to land at Travis AFB while performing some local pattern work for crew training.

personnel work tirelessly to make sure that all aircraft maintenance inspections are up to date, upgrades are applied and completed correctly, and spare parts are repaired or replaced to ensure the airframes are in safe flying condition.

'The main challenge', Budde explained, is the constant tug of war between who gets custody of the aircraft, as the maintenance personnel can't work on the aircraft while we're flying them, and we can't fly them while they're being worked on. While our aircraft are not always in perfect 'showroom' condition, we have great faith that the incredible safety focus of the air force, in combination with close co-operation between aircrew and the maintenance personnel, ensures that every time we leave the ground it's with safe, effective, mission-capable aircraft.'

All the KC-10s in the current USAF inventory are 'A' models, meaning there have not been any significant upgrades to the engines or airframes since they were delivered in the 1980s. However, improvements have been made, most significantly to the flight control systems and avionics.

The most recent upgrades aboard the KC-10 have been to the communications, surveillance, navigation and air traffic management system. This has brought the 60th AMW's KC-10s onto a par with current commercial airliners, which is vital as air traffic increases and airspace becomes more cluttered around the world.

The contract for the work was awarded to Rockwell Collins in 2011. It included the integration of a new flight management system with military flight planning and new inertial navigational units integrated with the existing analog autopilot. The program was completed in late 2016, and the whole fleet of KC-10s now have unrestricted access to worldwide airspace as well as new digital cockpit displays which replaced the old mechanical altitude director indicators.

Training

Several operational training sorties are flown each week. They usually consist of multiple in-flight refueling events, often with other aircraft from Travis such as the Lockheed C-5M Super Galaxy, Boeing C-17 Globemaster III and KC-10s. 'As well as performing air refueling training missions with other Travis-based aircraft', said Budde, 'we will also regularly team up with other tankers, transports and fighters from several air force and navy bases across the West Coast. These training sorties include a full spectrum of activities ranging from in-flight refueling to cargo upload and download operations, approaches and touch-and-go landings at Travis or nearby airfields.'

Above right: On the flight line is KC-10A serial 83-0078, while another is in the pattern.

Below: KC-10A serial 79-1948, callsign 'Quest 66', taxiing for departure at Travis for a morning training flight.

> With a few KC-10s, you have the ability to pick up an entire fighter squadron and move it across the country or even an ocean – a feat I continue to find extremely impressive

Travis is also home to an air refueling formal training unit (FTU). On average, 10 boom operator students pass through the FTU each year. This is a highly skilled and complex task as MSgt Lucero Stockett, a boom operator instructor, explained. 'I have been flying for 15 years, my entire career as a KC-10 boom operator. I have been a line instructor, formal training unit instructor and an evaluator. Once all new student boom operators have completed their simulator/emergency training procedures within flight safety, they head over to the FTU to complete the first stage of their air refueling training. The number of hours each student takes to complete this important element varies from student to student; you really can't put a number on it.

'Once they are signed off on refueling day heavy and night heavy aircraft, they will soon have the opportunity to complete their check ride or evaluation, which includes multiple dry contacts in the KC-10. Every student is a different challenge. Some pick it up very quickly while others need more practice and training.

'There are two types of qualifications, consisting of heavy aircraft [KC-10, C-5, C-17] and fighter aircraft. All student crew members have to complete 'heavies' refueling within the FTU while the fighter aircraft refueling training is generally completed by Travis' own in-house instructors while they are assigned to an operational flying squadron. This can be completed at the FTU if resources are available, but if this is not possible it will be completed through the FTU's mission continuation training. Both 'heavy' and fighter qualifications are required to become a mission-ready boom operator.

'After a student successfully completes their air refueling check ride, they move to the operational squadron where they begin the second part of their training, which is cargo management/loading. Passing their check ride and learning to load cargo takes approximately two to six months on average. Once again there are no set timelines or definitive number of hours for this stage — students must simply reach the required professional standard during their check rides.

'By utilizing in-house training and combining this with our front-line squadrons here at Travis, this helps minimize training time and acclimates our students to the operational squadrons as well as aircrew life. Students really benefit from this because every flight is different, and they are always learning something new.'

The remaining shelf life of the KC-10 Extender in service is limited, but a final decision on its fate has yet to be revealed. Travis AFB expects to receive the new Boeing KC-46A Pegasus tanker at some point in the next six years. Until then, Team Travis will continue to support the nation's military, any time, anywhere.

Left: Maj Bob Budde and a student pilot run through their pre-flight checks as part of the early-morning flight briefing.

Below: Budde in the right-hand seat of 'Xtndr 10' as the student to his left takes control in the busy KC-10 cockpit during an evaluation flight.

Bottom: Four Extenders basking under the Californian sunshine, waiting for their next training flight.

DESERT RESEARCHERS

NASA's largest flight research center is located at one of the most famous of all aerospace test sites. *Combat Aircraft* reports from Edwards Air Force Base, including an interview with NASA's chief test pilot Nils Larson.

REPORT **Frank Visser**

F-15B NASA 836 is one of three two-seat Eagles at NASA Armstrong and is used to flight-test aerodynamic, instrumentation, propulsion, and other flight research experiments. **NASA**

THE NATIONAL AERONAUTICS and Space Administration (NASA) flight test center at Edwards AFB dates back to 1946, when a small group of specialists from the then National Advisory Committee for Aeronautics (NACA) Langley Memorial Aeronautical Laboratory arrived at Muroc Army Air Base. The NACA deployment came here to participate in the first supersonic research flight with the Bell XS-1/X-1. For this program, NACA worked closely with the US Army Air Forces and Bell Aircraft. The most significant and famous milestone associated with it was achieved on October 14, 1947, when Charles 'Chuck' Yeager broke the sound barrier for the first time in his orange Bell X-1.

During the years that followed, what was now the NASA Armstrong Flight Research Center was renamed a number of times. Back in 1949 it was the High Speed Flight Research Station. This changed in 1954 to the High Speed Flight Station, and after the death of NASA's deputy administrator Hugh L. Dryden in 1965 it was decided to honor him by renaming it as the Dryden Flight Research Center. To pay tribute to Neil Armstrong — a former research test pilot at the center and the first man to walk on the surface of the moon — the facility at Edwards became the NASA Armstrong Flight Research Center on March 1, 2014. To remember Dryden, the Western Aeronautical Test Range — a 20,700-square mile restricted-airspace test range close to Edwards — is now called the NASA Hugh L. Dryden Aeronautical Test Range.

A varied mission

Today the Armstrong Flight Research Center is NASA's premier location for atmospheric flight research and operations. It is chartered to research, develop and test advanced aeronautics, space and related technologies and to conduct atmospheric earth and space science flight operations. It is the only NASA facility where the organization can check aircraft flight controls, avionics, electronics and other systems simultaneously. For this, it operates an exotic fleet of highly specialized manned and unmanned aircraft, which are flown by experienced test pilots.

The current chief test pilot at NASA Armstrong is Nils Larson. He started his career at the USAF Academy in 1986 and, after pilot training, became a T-37 instructor pilot. Later in his career he flew the U-2. In 1995 he went to the USAF Test Pilot School (Class 95A) at Edwards and following graduation he joined the 445th Flight Test Squadron at the same base, flying the F-15 and T-38. Unusually, he also graduated from the US Naval Test Pilot School at Naval Air Station Patuxent

Rich Cooper

River in Maryland. Retiring from the USAF in 2007 as a lieutenant colonel, he joined NASA as a test pilot. Today, he flies a variety of aircraft including the F-15, F/A-18, ER-2, T-34 and DC-8.

'The aircraft we use are well-suited for the job,' says Larson. 'They are not brand-new but we don't pull high-g turns with them. We take good care of our aircraft.' Through the years, nearly every type built for the US military has flown here with NASA. Amongst the more famous was the glorious bare metal B-52B, serial 52-0008, that was used as an airborne mothership for launching 'X-planes' such as the X-15 and the X-43. Other classics on the NASA roster here have included the SR-71, the F-8 Crusader and the F-111.

Above: For many years the NASA Armstrong Research Flight Center has operated two Beech King Air 200s (N7NA and N801NA) for a variety of support missions. **Frank Visser**

An enviable fleet

NASA Armstrong now employs more than 1,150 government and contractor personnel at its two locations. Its primary site is on the north-east side of Edwards, next to Rogers Dry Lake. The second is 20 miles south at Palmdale Regional Airport's building 703.

For years the F-15 Eagle has featured prominently in the NASA inventory, most famously the NF-15B (837), also known as the F-15 STOL/MTD (short take-off and landing/maneuver technology demonstrator). It was the first two-seat F-15 ever built by McDonnell Douglas. At NASA it was used to study the effects of thrust-vectoring and enhanced maneuverability, as well as acting as an avionics testbed for the F-15E Strike Eagle. During the following decade it was used as the F-15 ACTIVE (advanced control technology for integrated vehicles), before being retired at the beginning of 2009 as it completed a study of intelligent flight control programs.

Nils Larson, chief test pilot at the NASA Armstrong Flight Research Center. **Frank Visser**

Another charismatic — and extensively modified — F-15 was obtained in 1976 as NASA 835. Built as a YF-15A, it was the eighth F-15 manufactured and was used by NASA to develop a digital electronic engine control system. The aircraft later became known as the F-15A HIDEC

Below: The pristine F-15B NASA 836 (74-0141) is towed out for a morning sortie from Edwards AFB. **Frank Visser**

> “The aircraft we use are well-suited for the job. They are not brand-new, but we don't pull high-g turns with them
>
> **Nils Larson**

DRYDEN
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NO ENTRY WITHOUT CREW CHIEF APPROVAL

Left: Still wearing NASA Dryden titles, an ER-2 is prepared for a mission. The aircraft are heavily engaged in atmospheric research. **NASA**

(highly integrated digital electronic control), testing and evaluating a computerized self-repairing flight control system. It was an ambitious system that could detect damaged or failed flight control surfaces. NASA Armstrong now flies a trio of shiny white and blue two-seat Eagles. They are used as aeronautics research testbeds, as well as for crew training, pilot proficiency and safety chase support for other research aircraft.

The F/A-18 Hornet fleet serves as the primary mission support platform, several single- and two-seat variants assisting advanced programs. The role of safety chase includes photo and video chase, with the ability for the back-seat mission crew member to transmit live video streams back to control rooms for test monitoring.

A type that inevitably attracts a good deal of attention is the ER-2 high-altitude research vehicle. The NASA Armstrong Flight Research Center has two in its inventory, both based at Palmdale. Based on the USAF's U-2, the ER-2 is dedicated to high-altitude science and the aircraft are employed on a wide variety of environmental, atmospheric sampling and satellite data verification missions. They also carry out electronic sensor research and even satellite calibration.

From 1971 NASA employed U-2s to collect such data. However, the initial dedicated ER-2s arrived in 1981, with the second following eight years later. It is the only aircraft that can fly into the lower stratosphere at subsonic speed and it's a type in high demand. The two examples have deployed around the world on a range of tasks including ozone layer research in the Arctic stratosphere.

Another old bird at Palmdale is the NASA DC-8, which acts as NASA's Airborne Science Program flying laboratory. It flies three primary missions: sensor development, satellite sensor verification, and basic research studies of the earth's surface and atmosphere, while being heavily involved in monitoring tropical storms.

Palmdale is also home to the SOFIA (Stratospheric Observatory for Infra-red Astronomy) program. Conducted together with the DLR (Deutsches Zentrum für Luft- und Raumfahrt, or German Aerospace Center) this joint project was aimed at developing an airborne observatory to facilitate infra-red astronomy in the stratosphere. To carry the large telescope a Boeing 747SP was modified. A major modification added a door in the rear port fuselage that can be opened during flight. Behind this is mounted SOFIA's large telescope. 'SOFIA flies a lot and the unique thing about this aircraft is the stabilized telescope,' explained Larson.

SonicBAT

Of the many projects conducted by NASA here in the Mojave Desert, one of the latest is fascinating — sonic booms in atmospheric turbulence, or SonicBAT. The first half of this program, in which Nils Larson was intensively involved, was performed in the summer of 2016 by NASA Armstrong in order to examine the effects of atmospheric turbulence on sonic booms. For this NASA conducted 69 flights in a two-week period designed to study the way sonic booms travel through the atmosphere. 'Instead of collecting data during a couple of seconds in a wind tunnel we could gather real data in a hot and dry atmosphere up to 15 minutes during each sonic boom flight,' explained

Below: NASA 806 arrives at an airshow in style. Both ER-2s are based at NASA's facility at Palmdale. **Rich Cooper**

Armstrong Flight Research Center
ARMSTRONG FLIGHT RESEARCH CENTER
NASA
850

The F/A-18s are the workhorses of the NASA fleet, performing a host of duties including safety chase. **Frank Visser**

The skilled engineers who work at NASA Armstrong not only maintain a venerable and varied fleet, but make unique modifications for test work. **Frank Visser**

Larson. 'The F/A-18 was used to create these shockwaves by flying at a speed of Mach 1.38 at 32,000ft.'

On the ground the goal was to collect sound signatures from the sonic booms created by the F/A-18 after they had gone through the atmospheric turbulence layer before reaching the ground. For this, three microphone arrays were strategically positioned on the ground at Edwards. In the air, a TG-14A motorized glider collected sound signatures of the shockwaves. For this the TG-14A was fitted with a specially configured audio instrumentation package and a wing-mounted microphone boom. At the test point it would shut down its engine to eliminate unnecessary background noise. After the SonicBAT flights NASA compared the data recorded by the TG-14A with those of the ground arrays. This gave researchers a better idea of how atmospheric turbulence might influence sonic booms. The SonicBAT effort will develop two different models for the effects of turbulence on supersonic aircraft noise, the aim being to make future supersonic commercial aircraft quieter.

'Edwards was the ideal location for the first half of the SonicBAT program,' said Larson. 'Here you can test in a dry and hot environment and see how the turbulence layer is influenced by the rising heat during the day.' NASA expanded the tests to the Kennedy Space Center in Florida last summer.

Other programs are focusing on noise reduction on take-off and landing or improving fuel efficiencies and reducing potentially harmful exhaust emissions. For many years NASA has worked on an improved ground and airborne automatic collision avoidance system. Larson explained, 'I was involved in such a program many years ago flying the F-16. I avoided giving too many details of the test flights to my wife, thinking she would worry too much!'

Rising costs amid tight budgets

NASA Armstrong has a reputation for providing excellent value for money

NASA UNMANNED

For mission support the T-34C Turbo Mentor is used for research flights, photography and video. It is primarily used for chasing unmanned aerial vehicles (UAVs). NASA Armstrong Flight Research Center operates a modified MQ-9 Predator B and two Global Hawks. The Predator B — named *Ikhana* — is used for medium-altitude and long-endurance science missions. *Ikhana* also acts as a testbed to improve the utility of UAVs. NASA's two Global Hawks offer a range of 8,500 nautical miles and 24-hour endurance that enables them to operate worldwide. They have been used intensively for hurricane studies since 2010.

despite relatively adventurous projects. 'Before a program begins it's evaluated to see if it's worthy and realistic to put money into,' says Larson. 'Our engineers often have to specifically modify an aircraft so a specific test program can be executed. It's of great importance that we hire the best people for the job and we schedule all the programs so they can be done separately from each other.'

Sharing projects enables NASA to make full use of all possibilities. Working together with other government agencies and commercial companies alike enables the sharing of resources and subsequent findings. It's the test facilities in and around Edwards that act as a vital conduit for NASA's advanced test work. Larson specifically mentions the Rogers Dry Lake, adjacent to Edwards. 'This gives us the largest emergency runway in the US,' he says.

The range of projects is mind-blowing, from storm research to the Dream Chaser spacecraft. 'I am lucky to say that we have amazing teams here at NASA,' Larson comments. 'They have worked here for many years and are very experienced. Most of the pilots are also engineers, and the technicians do a great job in keeping these old birds flying.

'I think it's essential that test pilots join our [respective] programs at the beginning. They join the team in writing the requirements right through to flying the test aircraft. All my heroes have worked here, and now I sit in their offices.'

Left: Two F-16XLs were used by NASA to improve laminar airflow on aircraft flying at sustained supersonic speeds. **NASA**

Below: NASA's now-retired NF-15B (837) was also known as the F-15 STOL/ MTD (short take-off and landing/maneuver technology demonstrator). **NASA**

Bottom: NASA's venerable B-52B launch aircraft now resides at the base's north gate. It participated in some of the most significant projects in aerospace history before retirement in December 2004. **Frank Visser**

CUTTING EDGE

DISPATCHES FROM THE FRONT LINE OF AEROSPACE TECHNOLOGY

BY **DAVID AXE**

MARINES WANT A JAMMING, SPYING, CARGO-HAULING ATTACK DRONE

THE US MARINE Corps in early March 2018 asked the defense industry to provide information on a versatile new unmanned aerial system (UAS) that could replace the corps' aging EA-6B electronic warfare aircraft and complement existing surveillance, cargo and attack aircraft.

'Recognizing our current recapitalization toward a more diverse, lethal, amphibious and middleweight expeditionary force, the Marine Corps requires a UAS that is network-enabled, digitally interoperable and built to execute responsive, persistent, lethal and adaptive full-spectrum operations', its 2018 aviation strategy document explains.

The Marine Air Ground Task Force Unmanned Aircraft System Expeditionary program — MUX for short — aims to field the new drone starting in 2025. 'There is a need to close battlespace-awareness; electronic warfare; command, control, communications and computers; logistics and kinetic lethal fires gaps in aviation capabilities', the official request for information for MUX states.

The drone has to be capable of speeds of between 200 and 300kt while carrying a 3,000lb payload over distances from 350 to 700 miles. Perhaps most critically, the new vehicle must be compatible with a wide range of amphibious vessels, including America- and Wasp-class assault ships and smaller San Antonio-class landing docks. That means MUX will probably need to be capable of vertical take-offs and landings. The drone should be roughly as large as a UH-1Y helicopter, according to the RFI.

The marines' most urgent need is for a new aircraft to conduct early warning, surveillance, electronic warfare and communications relay, the information request explains. The corps' last two squadrons of land-based EA-6Bs are due to be decommissioned in 2018 and 2019 after four decades of service, leaving the branch without a dedicated radar-jamming platform until MUX enters service. The navy's EA-18Gs, which replaced the sailing branch's own EA-6Bs, are too big to take off from the assault ships' 850ft-long decks.

The marines have long sought a multi-role aircraft to round out the air components that embark on assault ships, giving the vessels many of the same capabilities as the navy's carrier air wings with their fighters, jammers and early warning aircraft. New F-35Bs, UH-1Ys, AH-1Zs, V-22s and CH-53Ks — all of which take off and land vertically — can provide marine wings with robust attack and transport capabilities. But the wings lack shipboard aircraft similar to the navy's E-2 radar platforms, which, like the EA-18Gs, take off and land conventionally.

> “MUX could become a kind of poor man's E-2 and EA-18G, but for assault ships instead of full-size supercarriers. The Marines also want the new drone to be compatible with lightweight weaponry

The Marine Corps is examining options for effectively replacing the venerable Prowler from next year. **Jamie Hunter**

MUX could become a kind of poor man's E-2 and EA-18G, but for assault ships instead of full-size supercarriers. The marines also want the new drone to be compatible with lightweight weaponry so that it can conduct 'all-weather, persistent, time-sensitive-targeting and strike, high-value-target attack… and kinetic, lethal, offensive air support', in the words of the RFI.

MUX could haul cargo to aid in the 'distribution of ammunition, water, rations, repair parts, fuel, medical supplies, mail and other commodities', but this mission is a lower priority and the marines 'may allocate [it] to other systems', the RFI states.

The corps' aviation strategy identifies two leading candidates for MUX. Northrop Grumman and the Defense Advanced Research Projects Agency (DARPA) are developing Tern, a propeller-driven, flying wing-style drone that takes off and lands vertically. DARPA has funded two Tern prototypes. The agency announced that Tern would fly for the first time in late 2018.

The other candidate is Ares, a joint effort by Lockheed Martin and Piasecki Aircraft 'to develop the next generation of compact, high-speed vertical-take-off-and-landing delivery systems', according to Lockheed. Ares features so-called 'ducted fans' — in essence, rotating propellers embedded within the wing. The companies originally intended Ares to perform a transport mission, but Lockheed claims the vehicle could also carry a module containing surveillance gear. Ares has been in development since 2009 but was yet to fly as of April 2018.

While awaiting information on possible MUX designs, the marines are experimenting with new digital radios that could equip the new drones, according to the aviation strategy. The corps is flying a pair of K-MAX robotic helicopters in order to 'expand the cargo UAS envelope, refine MUX experimentation and reduce risk'.

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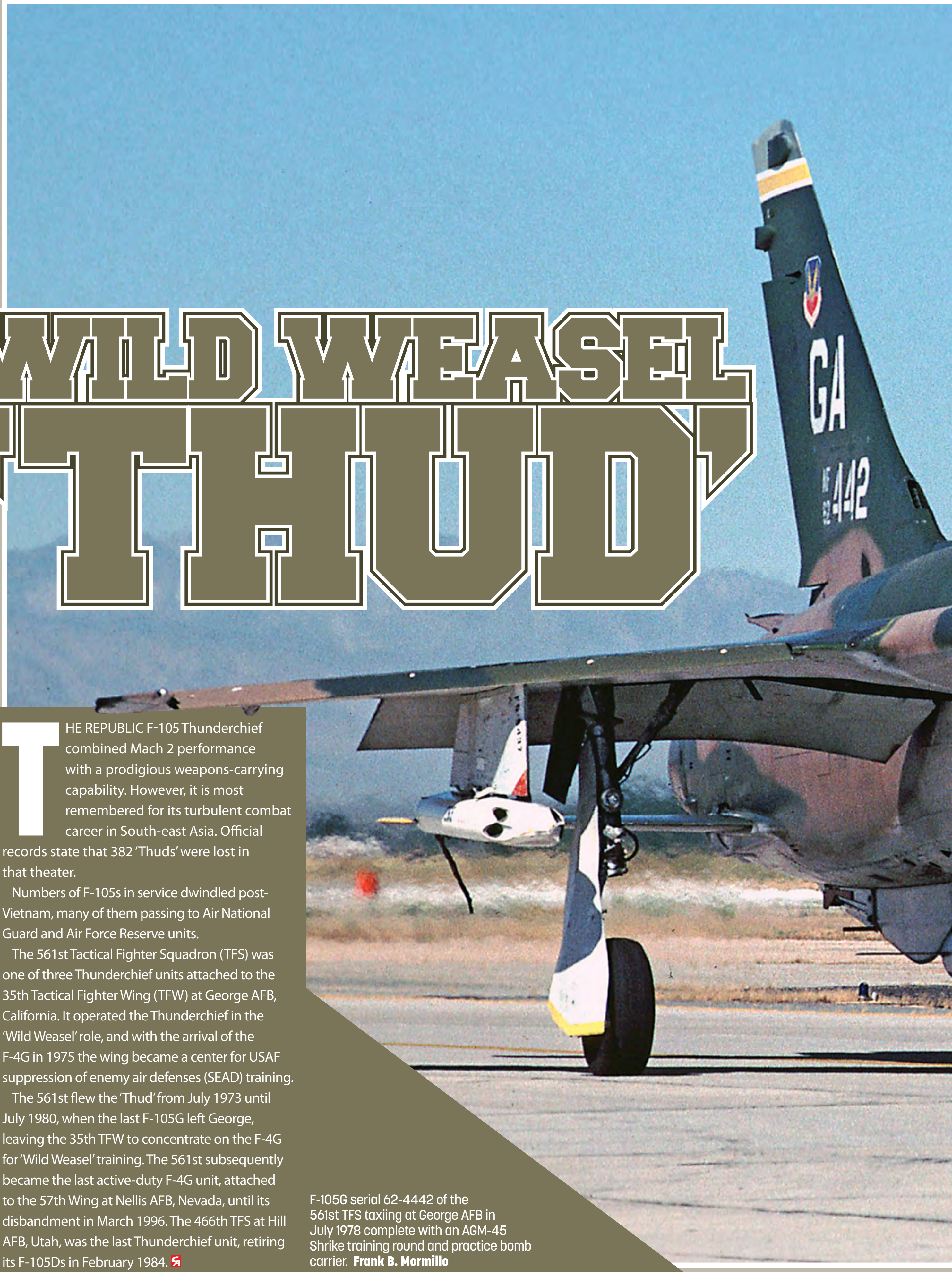
WILD WEASEL 'THUD'

THE REPUBLIC F-105 Thunderchief combined Mach 2 performance with a prodigious weapons-carrying capability. However, it is most remembered for its turbulent combat career in South-east Asia. Official records state that 382 'Thuds' were lost in that theater.

Numbers of F-105s in service dwindled post-Vietnam, many of them passing to Air National Guard and Air Force Reserve units.

The 561st Tactical Fighter Squadron (TFS) was one of three Thunderchief units attached to the 35th Tactical Fighter Wing (TFW) at George AFB, California. It operated the Thunderchief in the 'Wild Weasel' role, and with the arrival of the F-4G in 1975 the wing became a center for USAF suppression of enemy air defenses (SEAD) training.

The 561st flew the 'Thud' from July 1973 until July 1980, when the last F-105G left George, leaving the 35th TFW to concentrate on the F-4G for 'Wild Weasel' training. The 561st subsequently became the last active-duty F-4G unit, attached to the 57th Wing at Nellis AFB, Nevada, until its disbandment in March 1996. The 466th TFS at Hill AFB, Utah, was the last Thunderchief unit, retiring its F-105Ds in February 1984.



F-105G serial 62-4442 of the 561st TFS taxiing at George AFB in July 1978 complete with an AGM-45 Shrike training round and practice bomb carrier. **Frank B. Mormillo**

NEXT MONTH

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BECOMING A U-2 'DRAGONLADY' PILOT

USAF/SrA Gwendalyn Smith

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